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AN ANALYSIS OF THE ISSUES AFFECTING THE COAL SLURRY PIPELINE MO--ETC(U)
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NAVAL POSTGRADUATE SCHOOL

Monterey, California

THESIS

AN ANALYSIS OF THE ISSUES AFFECTING
THE COAL SLURRY PIPELINE MOVEMENT

by

Fred Alan Williams

March 1979

Thesis Advisor: R. W. Sagehorn

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CONT

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An Analysis of the Issues Affecting the Coal Slurry Pipeline Movement

by

Fred Alan Williams
Lieutenant Commander, United States Navy
B.S., University of Southern Mississippi, 1967

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
March 1979

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ABSTRACT

This thesis contains an examination, analysis, and commentary upon the prospective use of slurry pipelines as a supplemental means of coal transportation in support of the announced United States goal to double coal production by 1985. It examines the rudiments of the slurry industry and traces its growth to the present. A thorough review of the technical, legal, and political aspects of the controversial issues influencing the construction and operations of long distance coal pipelines is presented along with a commentary on the cases for and against slurries. Finally, sets of both general and specific conclusions are offered regarding the potential use of the coal pipelines.

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I. INTRODUCTION

Over the past two decades, coal transportation has been a heavily lobbied and debated issue in both the Congress and various state legislatures. Numerous arguments on whether coal slurry pipelines should be granted the power of "eminent domain" for the purpose of acquiring rights-of-way have been presented. Various industrial, labor, consumer, environmental, and governmental groups have taken sides on the issue and made countless numbers of statements in support of their views. Despite this flurry of activity, no consensus has been reached either on the central issue of granting eminent domain or any of the emergent side issues.

During the past several years the intensity of debate regarding coal slurry issues has increased dramatically. An increased awareness of the nation's declining oil and gas supplies coupled with the vulnerability of continued dependence on imported energy has forced the United States to reevaluate the future of coal, its most abundant fossil fuel, and to move toward its increased use. The expanded use of coal depends heavily on the availability and adequacy of economical long distance transportation to move the coal from the mine to consumer. Typically, coal transportation service has been in the domain of the railroads except in rare instances where unique factors have made other modes substantially more economical or convenient.

Because the public, the Congress, and the President all realized the urgency of America's energy crisis, it was politically expedient that some action be taken to ensure the energy independence of the United States. As President Carter forwarded his proposed National Energy Plan (NEP) to Congress in January 1977, he characterized and underscored the magnitude of the energy problem as follows:

> In each period of our history, the Nation has responded to challenges which have demanded the best in all of us.
>
> This is one of those times.
>
> Our energy crisis is an invisible crisis, which grows steadily worse - even when it is not in the news. It has taken decades to develop, as our demand for energy has grown much faster than our supply. It will take decades to solve. But we still have time to find answers in the planned, orderly way - if we define the changes we must make and if we begin now. (1:2)

II. OBJECTIVES

The objective of this thesis is to examine, analyze, and comment upon the use of coal slurry pipelines in light of a number of decisions which require the increased use of coal in overcoming America's energy problems. Of the multitude of issues raised by the opponents of coal slurries, only the four most volatile concerns will be discussed in this paper due to time and financial constraints imposed upon the author. These concerns include: (1) eminent domain; (2) environmental issues; (3) railroad/slurry competition issues; and (4) water use provisions.

While this paper will not attempt to evaluate the use of coal as a fuel, comment will be made where problems involving expanded coal use relate to slurry pipeline construction and operation. Since such tense issues as those regarding air pollution or mining methods will not be discussed, it should be noted that such topics require resolution if a viable slurry industry is to develop.

Each of the presently existing or proposed coal slurries will be examined. A short background statement, a comment concerning its present status, and a note of any significant activity will be related as appropriate to the discussion of the four problem areas. This dissertation will expose the strengths and weaknesses of the slurry industry in the clearest light possible.

In that a considerable number of recent studies have been made regarding the general subject of coal slurries, this paper will attempt to integrate the prevailing views of a majority of the experts in the field of energy transportation as it relates to the coal slurry concept. The ultimate objective of this document is to provide the reader with sufficient data upon which to draw an informative conclusion regarding the need for coal slurries and some perspective as to how best to use and monitor them if their construction is ultimately supported.

Since water and truck transport have not been a focal point in the arguments concerning the movement of Western Coal, any comments in regard to those methods will be only incidental. Additionally, the basic issues will be limited to those regarding low sulfur Western Coal rather than those of a national nature because all of the proposed slurry projects are generally localized in the Rocky Mountain Area with the exception of the recently announced Florida pipeline. Comments regarding the Florida pipeline will be made only under qualification since little is known about the project.

While it is known that the conclusions presented in this study will not be acceptable to all of the parties involved in the slurry debate, it is believed that they represent an objective summation and that they will hopefully assist in providing insight into the key elements of the slurry pipeline debate.

III. BACKGROUND

A. GENERAL

Coal slurry pipelines have received increasing attention on both the national and state levels over the past five years. Because they represent a new dimension in pipelining, this period has been compared to the early days of the oil pipelines. More appropriately though, this phase of slurryism can be related to the natural gas pipeline industry in the 1950's, a time of considerable growth and turbulence for that industry [2:1].

Only a short time ago, it seemed incomprehensible that coal could be transported by underground pipelines, much like oil and gas products that were being moved in the nearly half-million mile pipeline networks that exist in this country. In developing the slurry concept, its advocates found it unusual whenever they were not required to explain what "slurry" meant to anyone with whom they had contact. To an extent now, there are enlightened audiences that are growing quickly. Currently, the mere expression of the term can evoke an immediate emotional reaction, whether it be pro or con. Few middle-of-the-roaders exist on the slurry question because the stakes, whether measured in terms of money, water, or environmental quality, are extremely high.

In fact, the concept of moving coal by pipeline is not new. The first U.S. patent was granted in 1891 to Wallace C. Andrews, who had constructed an actual pilot plant on the

corner of 58th Street and Madison Avenue in New York City. His creation stretched across several vacant lots and looked much like an amusement park roller-coaster because he had built wooden trestles to support the pipeline and to simulate hills and valleys. Although no record can be found to substantiate any commercial application of Andrew's invention, it is known that he built and exhibited a second coal slurry at the Columbia World's Fair held in Chicago in 1893. At that event, Andrews was given an award for his creativity [3:3].

Since that auspicious beginning, only two operational coal slurries have been built in the United States. The first was the Cadiz (Ohio) Pipeline which began operation in 1957 and ran successfully for six years. It was retired when it had completed its primary mission, the forced reduction of the rail rates for coal deliveries in that part of the country [4:267]. The second, the Black Mesa Pipeline in Arizona, has been in continuous operation since 1970. Serving Southern California Edison (SCE), it is the sole source of fuel for the 1500MW Mojave power plant in southern Nevada. The experience of this system has been excellent as indicated by the statement of SCE's Chairman of the Board, Jack K. Horton, before the House Interior Committee in March of 1975:

> From the time the pipeline began commercial operation on November 1, 1970, it has been needed to transport coal for 40,896 hours and (it) has been available for 40,554 hours . . . Our experience to date indicates that the Black Mesa Pipeline has transported coal to the Mojave plant at a cost benefit of nearly 50% below that of alternative transportation costs. Another of the more attractive features of the slurry pipeline is the relative freedom from inflationary impacts: . . . therefore, substantial savings are not only being realized, but are anticipated to continue to the benefit of millions of electric power consumers because of the economics of the coal slurry pipeline. . . [2:E2].

Based upon Mr. Horton's statement one could generally conclude that the technology of slurries is well proven, reliable, and cost effective, but there are many who would challenge these concepts. For instance, Louis Menk, Chairman and Chief Executive Officer for the Burlington Northern Railroad, testified before the House Interior Committee on November 7, 1975, that:

> Coal slurry lines ordinarily cannot be self-supporting. . . pipeline technology is in its infancy. . . costly developmental problems will impair the projected transportation savings . . . of coal pipelines. [5:15]

With Mr. Menk's and Mr. Horton's sworn testimony exhibited, it becomes apparent that diametrically opposed views exist, not only on the issues, but also on the facts, regarding coal slurry pipelines. These contradictions are not only existent on top level views, but they pervade the entire body of knowledge regarding the subject of coal distribution in America. It is with this perspective that antithetical opinions are rampant that this study will examine the issues of eminent domain, environmental concern, rail-pipe competition, and water use as they relate to the construction and operation of coal slurries.

Prior to discussing the issues, it would be prudent to submit data pertinent to the major coal slurry projects either in operation or under proposal in the United States today. The routes of the eight major systems are shown in Exhibit 1 and further described in Table I.

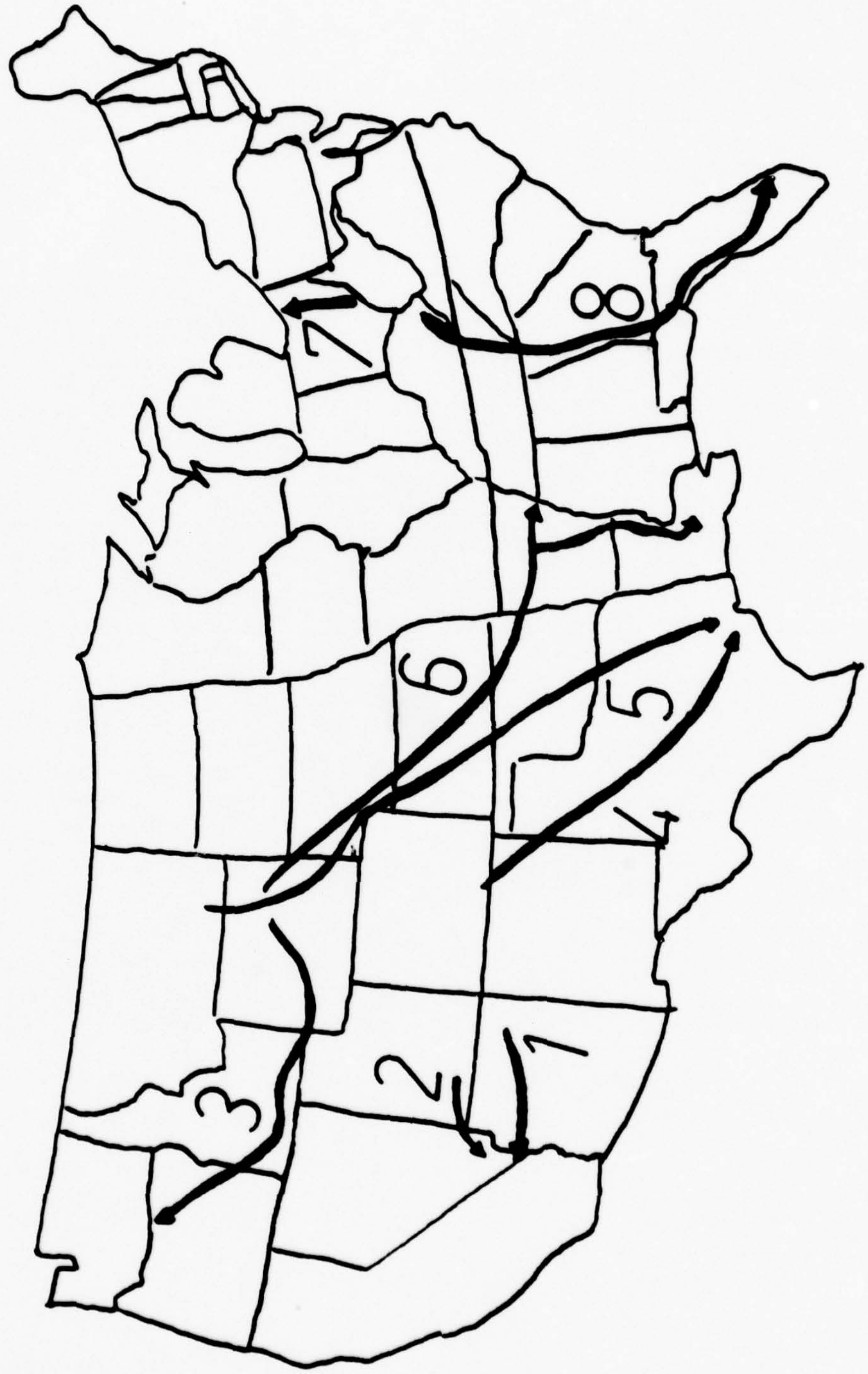


Exhibit 1

TABLE I
COAL SLURRY SYSTEMS

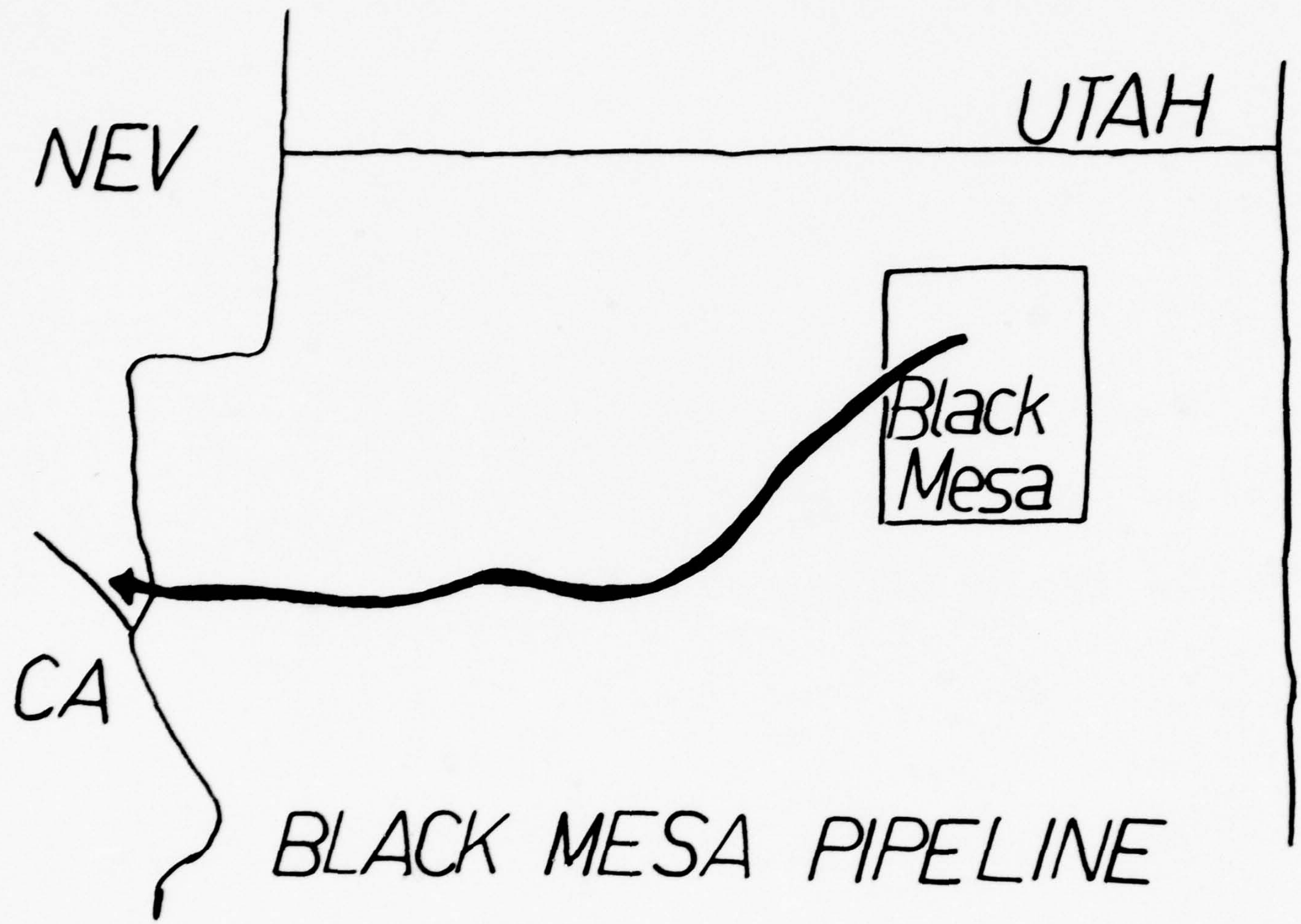
	PIPELINE SYSTEM	LENGTH (in miles)	ANNUAL CAPACITY (in tons)
1.	Black Mesa Pipeline	273	4,800,000
2.	Alton Pipeline	183	11,600,000
3.	Gulf Interstate-Northwest Pipeline	1100	10,000,000
4.	San Marco Pipeline	900	15,000,000
5.	WYTEX Pipeline	1260	22,000,000
6.	ETSI Pipeline	1378	25,000,000
7.	Cadiz (Ohio) Pipeline	108	1,300,000
8.	Florida Pipeline	11-1500	15-45,000,000

B. THE BLACK MESA PIPELINE

The Black Mesa Pipeline is 278 miles in length and crosses the rugged terrain of northern Arizona from Black Mesa, near Kayenta, to the Mojave power project in Southern Nevada. (See Exhibit 2) Built for $39 million in the 1968-1970 time frame, this system is presently the only active coal slurry in the United States [6:24]. Its initial 266 miles ran as an 18-inch line over terrain that rises and falls in altitude between 500 and 6500 feet and then the pipeline tapered to a 12-inch pipe over the last 12 miles as the elevation drops 3000 feet [7:1086].

The line was established after Southern California Edison began searching for an alternative to higher than anticipated rail cost for supplying its Mojave generating plant. When the pipeline was initially proposed in 1966, the Southern Pacific Railroad directed its subsidiary Southern Pacific Pipelines to investigate the feasibility of building a coal slurry line. After research determined that such a project could be economically productive, Southern Pacific Pipelines created the Black Mesa Pipeline Company to build and operate the Black Mesa Pipeline [7:1086].

The pipeline's water needs are supplied by a set of five deep wells near Kayenta, Arizona. The wells, each over 3000 feet deep, are steel encased to prevent seepage into or out of the wells into the potable, shallow water supplies of the local areas. At full capacity, the wells provide 4200 gallons of water per minute to push 660 tons of coal per hour through the line at



BLACK MESA PIPELINE

Exhibit 2

5.8 feet per second (fps). The slurry transit time from Black Mesa to Mojave is 67 hours and the line holds approximately 45,000 tons of coal at any one time. The four pump stations employ the world's largest postiive-displacement pumps to move their cargo. The pumps, driven by 1700 hp General Electric Motors, use 12-inch pistons except at the Gray Mountain booster station, where slightly scaled down 1570 hp motors drive pumps with 10-inch pistons [8:45]. At each station, there are dump ponds with enough capacity to hold all of the slurry carried in the upstream portion of the pipeline. These ponds, built as contingency measures, would be used only in case of an emergency which necessitates the emptying of the line [7:1086].

The pipeline is fully automated. It is run by a four-man shift at Kayenta and is controlled by means of a General Electric GETAC 7020 Supervisory Control System. A solid state microwave system is employed to pass commands between the control and operating systems. The four-man crew, as well as the monitoring system, continually check the slurry for per cent of solids, density, specific gravity, ph and flow rate. Only once has the line been plugged during operation and that was in its first half-year of operation. Following a restart subsequent to several power failures, a forty-foot plug of solid coal developed within the pipe. It was removed by a proprietary method developed by the Black Mesa Pipeline Co. and there has been no such problem since [7:1086].

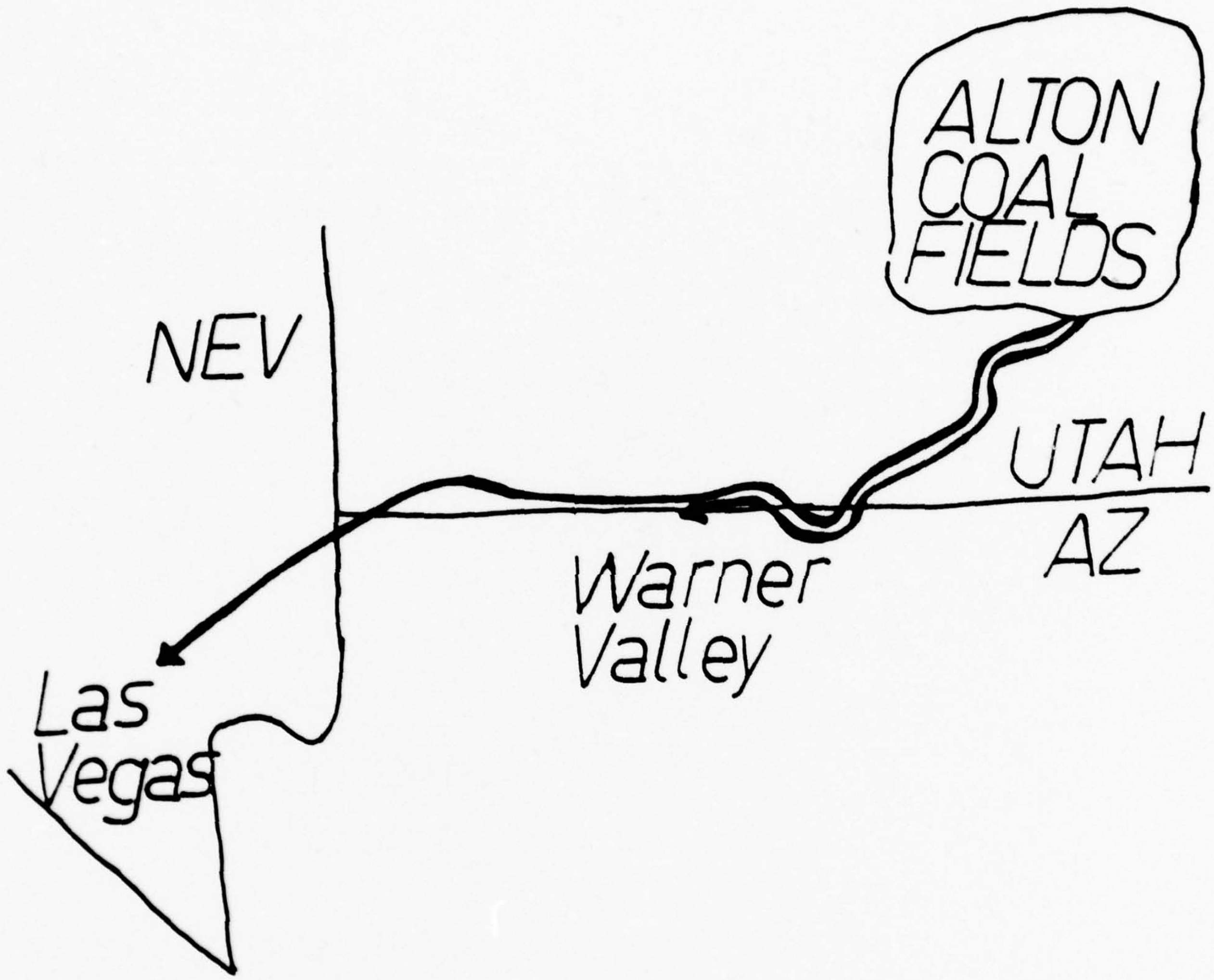
The system has completed over eight years of successful operations. It is considered by its parent company to be both

a technical and an economic success. While it is capable of transporting over five million tons of coal per year, it has averaged only about four million due to the burn rate of the power plant. However, the need for electric energy in the Southwest has begun to accelerate and the coal burn rate has been increasing as evidenced by the pipeline's 1977 throughput figure of 4.6 million tons.

Black Mesa's manager, John Montfort, projects that, "There is definitely a future for coal slurry pipelines in the United States." [7:1086]

C. THE ALTON PIPELINES

Actually two pipelines will be constructed under this proposal by the Nevada Power Company. (See Exhibit 3) The two lines are one of the five components in what is called the Allen-Warner Valley Energy System. The longer of the two pipelines will run from the Alton coal fields in southern Utah to the Harry Allen Generating Station twenty miles north of Las Vegas. It will consist of 164 miles of 22-inch pipe and 19 miles of 20-inch pipe. It is designed to deliver 9.1 million tons of coal annually. Its smaller parallel sister will consist of 68 miles of 12-inch pipe and five miles of 8-inch pipe and it will deliver 2.5 million tons of coal annually to the Warner Valley Generating Station. Both pipelines are designed to operate around the clock seven days a week at a 95-98 percent availability [9:3].



ALTON PIPELINE

Exhibit 3

The temporary construction rights-of-way will be 100-feet wide while the operational rights-of-way will be one-half of that. The rights-of-way will be mostly unencumbered and will be returned to the pre-existing uses after the completion of construction. Of the 183 miles to be crossed, 142 are federal lands, 21 are state or county lands, and only 20 are private [9:4].

Water will be supplied from a deep ground water aquifer in the Navajo Sandstone Formation. The two lines are expected to use between 5400 and 7800 acre-feet per year, depending upon the burn rates at the two generating stations and the amount of inherent moisture in the coal [9:4].

The Alton's preliminary environmental and engineering studies were performed by Engineering Management, Inc., under the direction of the Black Mesa Pipeline Co.. In April of 1974, Nevada Power submitted a six-volume report to the Bureau of Land Management to supply the Federal government with the data necessary for the completion of the Environmental Impact Statement (EIS) required by the National Environmental Policy Act. Since September of 1975, the government has continually returned for additional information and Nevada Power has submitted an additional six volumes in a piecemeal fashion [9:5].

Nevada Power has been somewhat dismayed by continuous governmental back-peddling and stalling tactics. John Arlidge, assistant to the Vice-President of Nevada Power, stated in a speech at the Second International Conference on Slurry Transportation in 1977 that changes in the Federal review process

had caused long delays in the Alton project. As an example, he described how a change in the Department of Interior's policy on reviewing future coal leases had caused his company a two-year delay. He continued that the power utility industry as a whole was seriously concerned about the lengthy delays being caused by government red tape. He asserted that growing regulations had caused "a three-fold increase in time and a six-fold increase in cost" over the requirements for construction of utility projects since 1960 [9:6].

The Alton's approved EIS is expected to be issued by mid-1979 and it will clear the way for obtaining the necessary permits required for the construction of the energy system. Although pipeline construction will require only one year, it will be delayed while the power plant generating units, the constraining elements in the project, are sequenced in over a nine-year span. The first units will go on line in 1983 at Warner Valley and in 1985 at Las Vegas' Allen Station. Subsequent units will be phased in at one-year intervals at both sites following installation of the inaugural units. The pipelines' initial operations will coincide with the beginning operations of their respective power plants [9:7].

D. THE GULF INTERSTATE NORTHWEST PIPELINE

This pipeline, originally proposed by Gulf Interstate Corporation of Houston and Northwest Pipe Company of Salt Lake City in 1975, has become little more than a market study. (See Exhibit 4) The original feasibility study called for a pipeline between 800 and 1100 miles long running between Wyoming and

GULF INTERSTATE-NORTHWEST PIPELINE

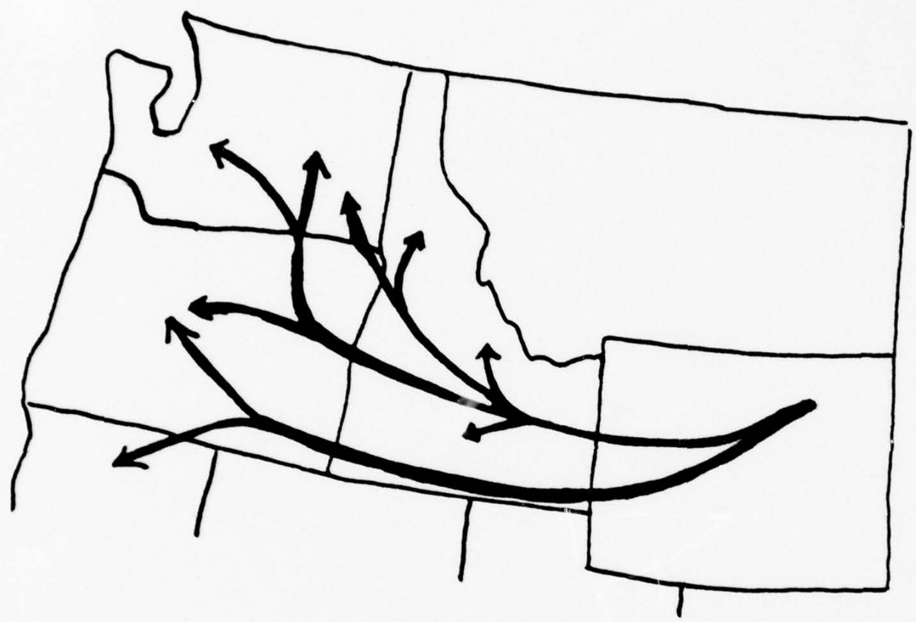


Exhibit 4

various Pacific Northwest locations. (Specifically announced as Bordman, Oregon.) [10] The pipeline would have been between 20 and 24 inches in diameter although a number of other sizes were also researched.

When the proposal was originally announced, it was spurned by the utility companies of the Pacific Northwest even though all of the available dam sites in the hydro-electric rich area were in use. Because of environmentalist pressure to maintain the air quality of the region, the utilities had made a conscious choice to move toward nuclear generating capability over the foreseeable future rather than use coal-fired plants. Accordingly, the pipeline proposal was shelved, but it has not been dismissed.

Ed Hayes of Northwest Pipe stated in January of 1979 that "... if a substantial switch from nuclear to coal were made, then the pipeline would be restudied for the earliest possible construction." According to Mr. Hayes, Northwest's present desire would be to build a 48-inch line of 700 to 800 miles from Wyoming along the Snake River to Boise, Idaho, and then over to Washington or Oregon. The desire would be to have multiple pick-up and drop points, at least two of the former and as many as five of the latter. It was projected that the maximum water requirement for a plan of this magnitude would be 200,000 acre-feet over a twenty-year period. Northwest's opinion as to construction cost in 1979 dollars for such a venture was set at roughly one and a half billion dollars. Although design could be accomplished within a year and actual construction could be accomplished in a three-year period, Hayes believed that without

help in each of the four basic problem areas to be discussed in the following chapter, it would require in excess of twelve years to construct a slurry as things presently exist [10].

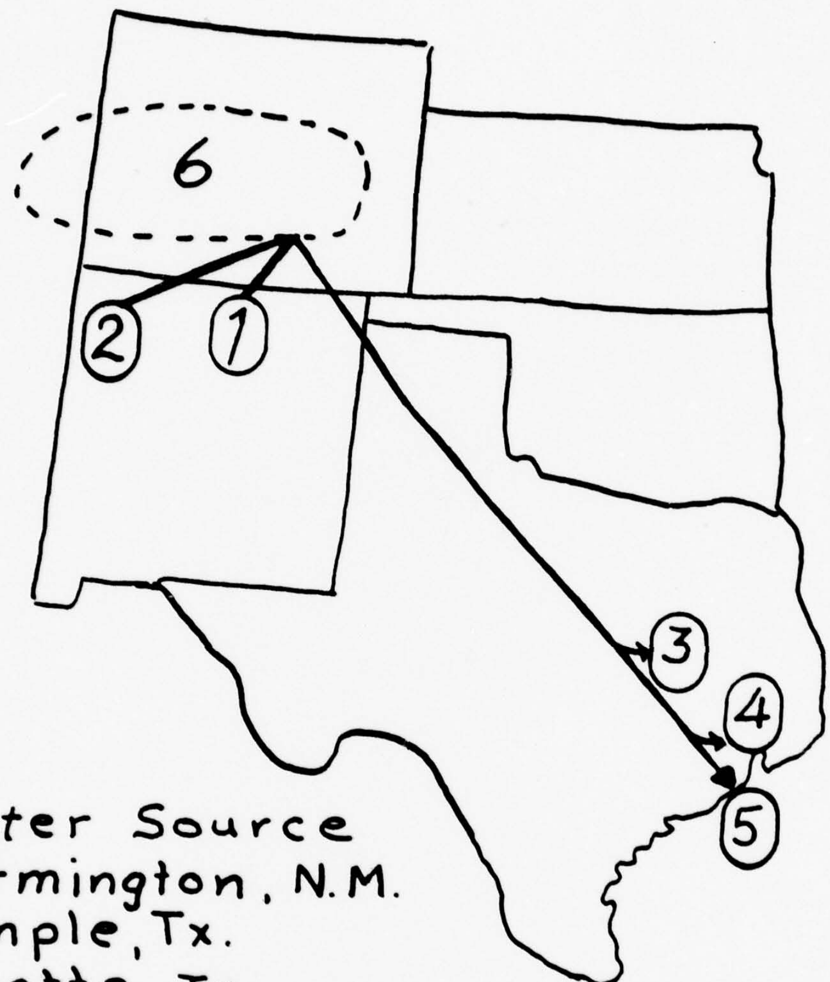
E. THE SAN MARCO PIPELINE

Interestingly enough, the San Marco Pipeline, like the Black Mesa, is another railroad venture. It is co-sponsored by Rio Grande Industries, owner of the Denver and Rio Grande Western Railroad (D&RGWRR), and Houston Natural Gas Co. Designed to run approximately 900 miles from Walsenburg, Colorado, to Angleton, Texas, it will employ nineteen pump stations to maintain a flow rate of 5.7 to 6.5 FPS. (See Exhibit 5)

The pipeline will be controlled by a central supervisory system in Colorado and will be unmanned elsewhere. Microwave transmission, backed by redundant land lines, will provide for control communications [11:12]. The line is designed to have a 222-mile feeder spur of 16-inch diameter from Farmington, NM, to Walsenburg, which would deliver approximately five million tons of coal to the origin each year. It was envisioned that the D&RGWRR would deliver the additional coal required for the line from mines in the Walsenburg area.

From Walsenburg, it was planned that a 625-mile segment of 28-inch pipe would be run to Temple, Texas, in which fifteen million tons of slurry would be carried. Five million tons would be used in Temple and the remaining ten million tons would be run through a 90-mile segment of 24-inch pipe to Fayette, Texas, where another 2.5 million tons would be dropped. The remaining 7.5 million tons would run via a 20-inch line 110 miles to Angleton, Texas [11:13].

SAN MARCO PIPELINE



1 Water Source
2 Farmington, N.M.
3 Temple, Tx.
4 Fayette, Tx.
5 Angleton, Tx.
6 Railroad Pick up Area

Exhibit 5

Surface water was not available in the Walsenburg area to supply the 10,000-acre-feet per year required; therefore, the San Marco Pipeline Co. had to run several hydrological engineering studies to validate whether or not any of several potential nearby water sources could be depended upon for long-term use. One area near the New Mexico border appeared to meet the pipeline's requirements and the land and its water rights were purchased; however, the San Marco Company, in accordance with Colorado and New Mexico law, must prove that an adequate quantity of water exists in the aquifer to meet its needs without jeopardizing the existing water balance in the general area. In the last quarter of 1978 an eleven-inch test well was drilled at the water development site and approximately 3200 gallons per minute (GPM) were extracted with no drawdown on the aquifer. A 10-day legal test was run in December 1978 to be used as evidence of the adequacy of the water supply in a presently scheduled March 1979 water court hearing. San Marco officials hope that the water issue will be resolved by June, 1979 [12:1].

F. THE WYTEX PIPELINE

In this proposal prepared by Brown and Root, TETCO, and Shell Oil Co., the coal is to be surface mined at four sites in the Power River Basin of Wyoming and delivered to crushing plants adjacent to each mine. After crushing and blending to make pumpable slurry, the coal will be fed through eighteen-inch gathering lines to the main slurry pipeline. The main line will be a 36-inch, 1260 mile pipe traversing five states and terminating near the Texas Fulf Coast. (See Exhibit 6) The line will have a capacity

of 21.6 million tons annually and will employ eleven booster stations along its route.

This pipeline design proposal features distribution pipelines which may branch from the main slurry at any point where a suitable customer is found. Each branch line could deliver up to 5.4 million tons per year. At the end of each branch and at the terminus of the main line, dewatering plants would be built to remove most of the slurry's free water, whereupon the coal would be delivered to the using site for grinding, drying, and subsequent burning. Preliminary investigation has also been accomplished on this pipeline using both 42 and 48-inch pipelines and consideration has also been given to the construction of a Texas to Wyoming water return line.

Although no water supply exists as yet for this proposal, the following circumstances do exist. The project will require nearly 11,000 gallons of water per minute. Since the passage of restrictive legislation in Montana in 1973 (The Montana Water Use Act), it is known that no water from Montana could be used in the project. Because the ETSI pipeline had been able to secure Wyoming water by act of the state legislature, it is possible that this project could attempt similar action. If water were to be granted, it is planned that eight wells would be sunk in the Madison aquifer to provide water. Only six of the wells would be required at any one time with a seventh used for standby maintenance and the eighth used for emergency [13].

WYTEX PIPELINE

Exhibit 6

G. ENERGY TRANSPORTATION SYSTEMS, INC. (ETSI) PIPELINE

The ETSI pipeline is the most highly developed of the presently proposed large slurries. Although announced in 1975 as a 1036 mile 38-inch line to run from Gillette, Wyoming, to White Bluff, Arkansas, via Nebraska and Kansas, its length and routing have been subject to change proposals which would run it through Colorado and Oklahoma while retaining its origin and destination sites [14:7]. As recently as January, 1978, it was announced that an extension would be built to Baton Rouge, LA, which would increase its overall length to 1378 miles [15:7]. (See Exhibit 7)

Designed to move 25 million tons of coal per year from the Powder River Basin, the pipeline is sponsored by ETSI to support Middle South Utilities (MSU), a five-state utility conglomerate located in the lower Mississippi Valley. MSU has reported that it expects to use the ETSI line in excess of thirty years.

Water usage for the project is expected to run approximately 15,000 acre feet per year. After an extensive lobbying effort, ETSI has received authority from the Wyoming legislature to use 20,000 acre feet of Wyoming water annually in support of its project. The water will be taken from the Madison aquifer by drilling deep (2500 feet) wells [14:1].

Despite ETSI's successes in obtaining customers and water rights, there have been problems in the securing of rights-of-way. Until late 1978, it appeared that ETSI's inability to secure the required construction and operating rights-of-way from various railroads along its route would provide serious obstacles to the

ETSI PIPELINE

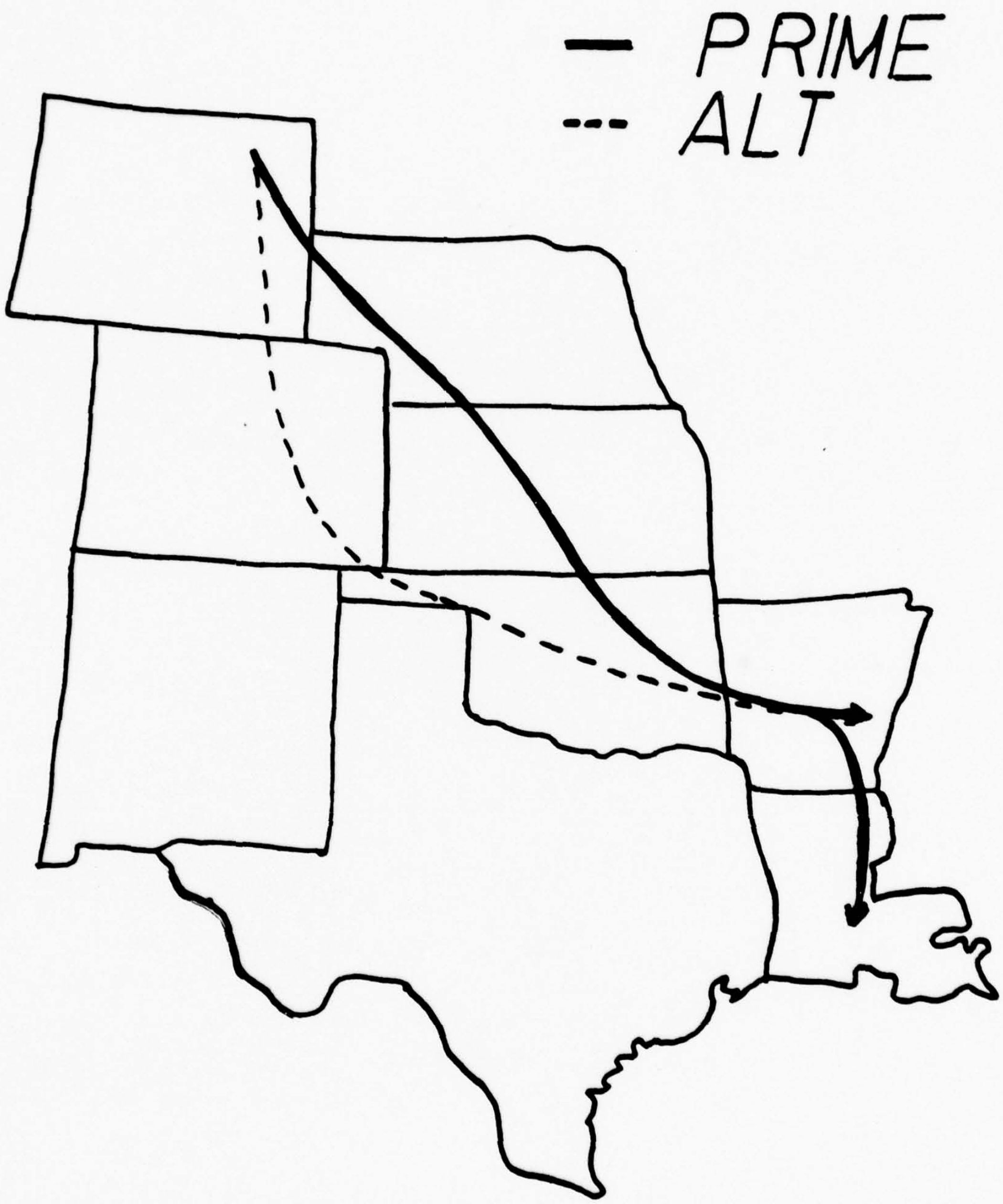


Exhibit 7

ultimate construction of the pipeline; however, in a serious of 66 court victories, ETSI now appears ready to build [17:7].

H. THE CADIZ (OHIO) PIPELINE

The Cadiz pipeline was the first of the modern slurries. No study could be complete without a discussion of the now "moth-balled" Cadiz line. Part of the significance of this line exists in that no commercial coal slurry had ever existed prior to its construction. Constructed and owned by the Consolidated Coal Co. (CONSOL) of Pittsburg, PA, the 110-mile 10-inch pipeline ran from Cadiz, Ohio, up to Cleveland Illuminating Company's Eastlake Power Station near Lake Erie. (See Exhibit 8) It employed three pumping stations, each using three 450 Lp positive displacement double action duplex piston pumps capable of pumping 1100 GPM. The line was in operation for six years and experienced an availability rate in excess of 98 percent. It averaged over 1.3 million tons of coal moved annually during its active lifetime [18:555].

Since its shutdown in 1962, it has remained idle. Only once has an active proposal been made to reopen the line and that was as a garbage slurry to remove a sizable portion of Cleveland's waste to the Cadiz area. Local opposition in the Cadiz area forced an end to that proposal [19:3-2].

I. THE FLORIDA PIPELINE

The Florida Pipeline is the newest of the coal slurry proposals and it is the first active one in the eastern coal regions since 1962. Although originally announced as a 1500-mile line

CADIZ (OHIO) PIPELINE

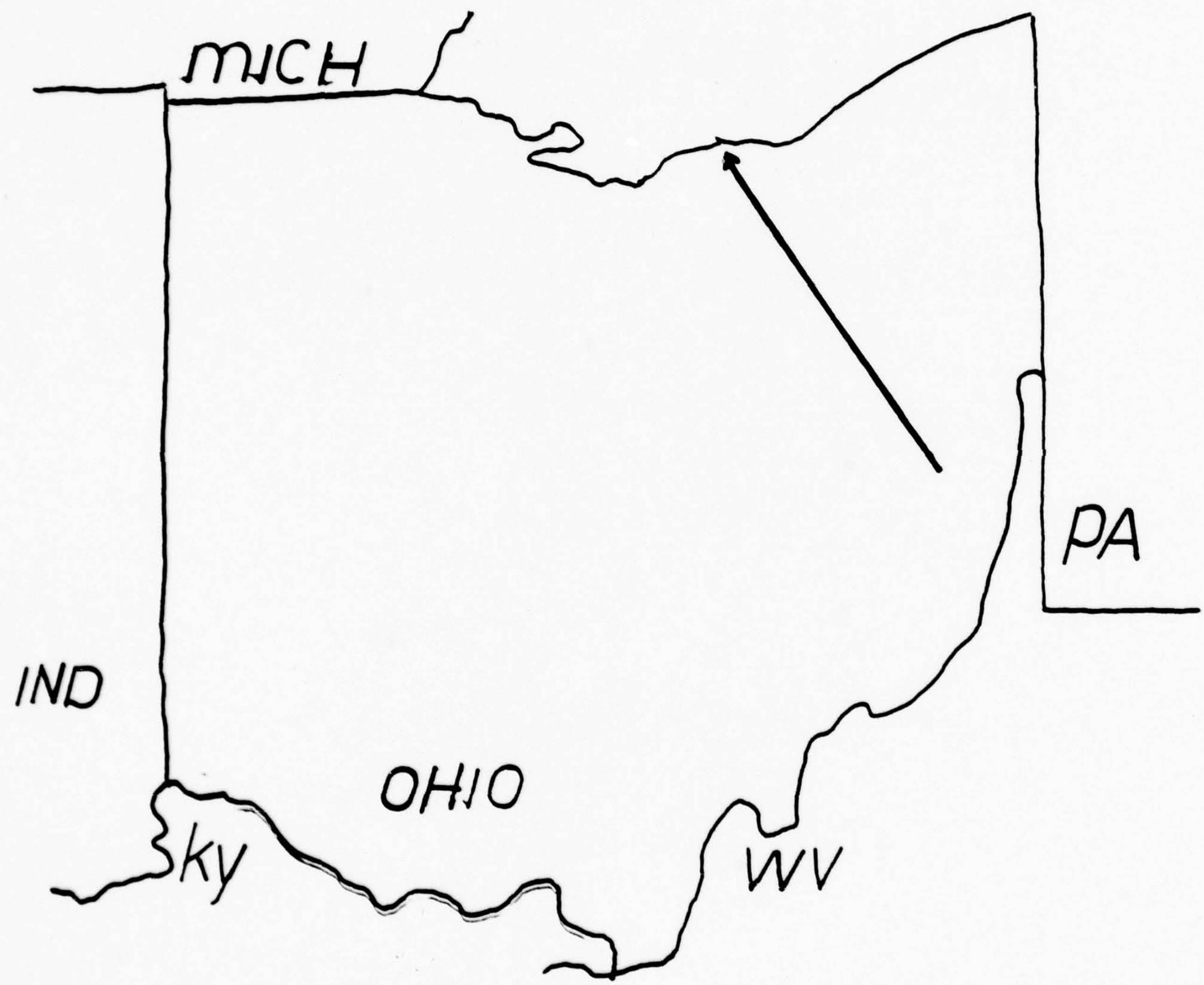


Exhibit 8

running from Eastern Kentucky to Southern Florida, the project has remained flexible as to origin and destination according to Jim Kaufman of Florida Gas [20]. In fact, the initial feasibility study looked seriously at the coal in Illinois, Tennessee, Ohio, Kentucky, West Virginia, Pennsylvania, and North Carolina [21:6].

At the time of the slurry's announcment, Florida Gas had completed its initial feasibility study and a limited marketing study. It concluded that the kind of pipeline it desired to build would run approximately $1.6 billion (1978 dollars). Since that time, the company has completed a second level study which has been closely guarded. Kaufman suggests that Florida Gas is near term in announcing its final plans and that the slurry could be built quickly "if everything went right" [20].

Prospective customers along the slurry's route include Georgia Power, Florida Power, Seminole Electric, Florida Power and Light, Tampa Electric and Gulf Power Co.; however, Kaufman cautions that other utility systems have not been excluded. Florida gas expects both the Seabord Coast Line and the Southern Railroad to put up stiff competition to their construction efforts. Both of these railroads are in good financial health and they represent a formidable challence. In the absence of federal legislation granting the power of eminent domain, Florida Gas sees little point in beginning their pipeline. It is their position that legislation is much more positive and certainly is less expensive than the use of judicial persuasion [20]. (See Exhibit 9)

FLORIDA PIPELINE

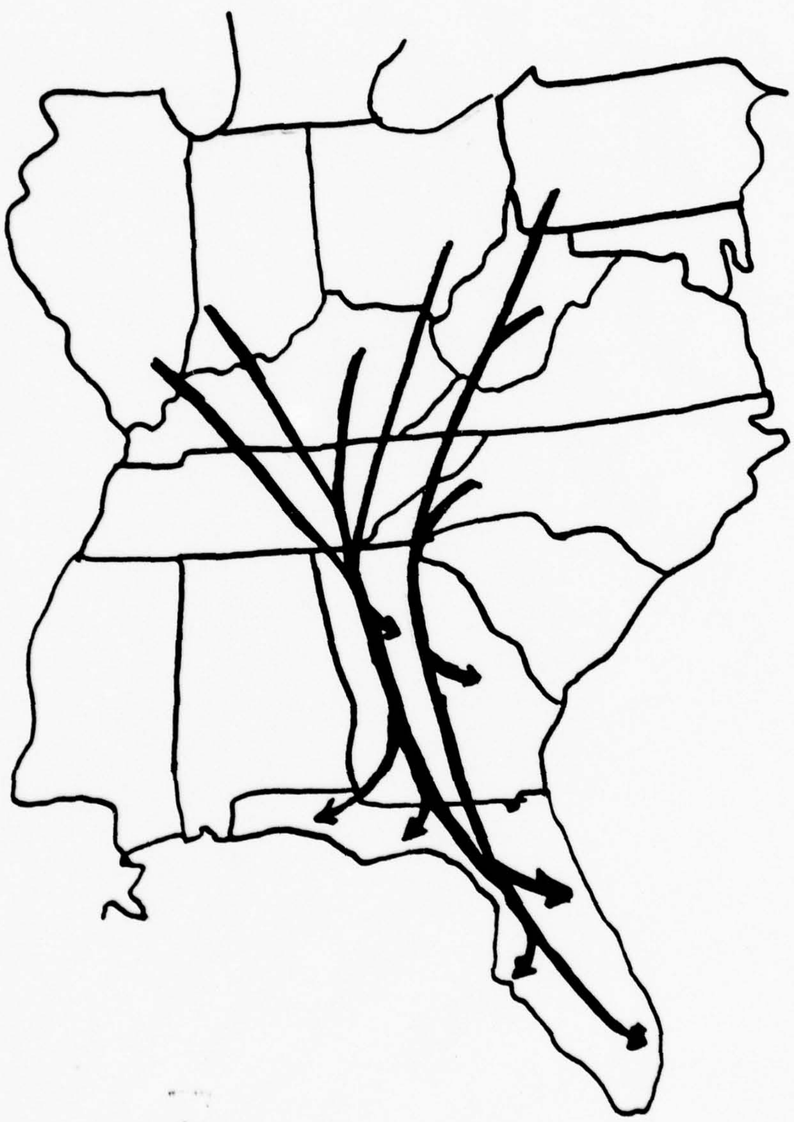


Exhibit 9

IV. THE ISSUES

This chapter will discuss four of the most volatile problem areas which have in the past or are presently delaying the construction of coal slurry pipelines in the United States. The most long-standing and probably the central issue has been one emanating from the slurries' inability to secure right-of-way rights. In this argument over passage rights, the slurries have fought for the right of eminent domain at both the state and federal levels. In addition, judicial action has been exercised in a number of cases to ensure the use of rights-of-way along the route of the ETSI Pipeline.

Because the eminent domain fight has lingered for nearly two decades, a number of other issues have arisen. These emergent issues have had a dramatic effect on the budding slurry industry in general and specifically on the right-of-way issue.

One of these new issues, that of preventing environmental damage was born with the initiation of an environmentalist movement during the late 1950's and early 1960's. Although the environmentalists remain formidable as a group, the real effect of the movement upon industry presently lies in a number of federal and state agencies which have been created in response to environmentalists pressures to administer, evaluate, and monitor the programs which have been set up by legislative mandate, presidential edict, or judicial decree. Federal legislation regarding clean air and water, ecological damage, and other

environmental impacts have placed substantial burdens on all industries, including coal slurries, to protect the environment. The slurry industry will be examined with respect to its responsibilities under the growing body of environmental law and with regard to its response to environmentalist groups.

A third issue affecting the establishment of the proposed coal slurry pipelines is that of slurry-railroad competition. Again, a number of side issues have arisen, those of transportation regulation, energy consumption and use of construction resources, come into play whenever a discussion involves this, the competitive aspect. The railroads have stedfastly accused the slurry advocates of misrepresenting its economic benefit and of downplaying the railroad's ability to transport the nation's coal. In turn, the slurrymen have complained that the railroads are out to stifle competition and maintain a monopolistic advantage. Consumers, such as industry and utilities, are anxiously taking sides on the issues in hopes of gaining a competitive advantage if their side wins.

The final dominant issue to be discussed in this chapter will be in regard to the use of scarce western water. The water issue became a paramount concern only because nature chose to place America's vast quantities of low-sulfur coal west of the Mississippi River where the annual rainfall is about one-fourth of the amount found in the Eastern United States. Hugh quantities of easily-mined coal lie near the surface of much of the Northern Great Plains States where only 10-12 inches of rain falls annually. Unfortunately, most of the presently proposed

coal slurries have been designed to haul coal from this particular region where water has been typically closely guarded as a precious commodity. Had the slurries been proposed to move eastern coal, a water issue would probably never have emerged, but the pipelines were planned for the West, the issue does exist, and it has proven to be quite significant because of its importance to the populus in general.

These four issues: (1) eminent domain, (2) environmental concern, (3) rail-slurry competition, and (4) water use have become the primary obstacles to the furtherance of a bona-fide coal slurry industry. Unless the slurry proponents can overcome their opposition in each of these areas, they are destined for "pipedreams," not pipelines.

A. EMINENT DOMAIN

1. Its Definition and Origin

Before entering a detailed discussion of the activities surrounding the passage of eminent domain legislation, it would be worthy to define eminent domain and describe its origin and use in this country. Eminent domain is commonly applied to acts in which the state takes private property for a public use. As a concept it actually comes from the right of expropriation which developed in English law as:

> ... the right or power of the sovereign, or those to whom power has been delegated, to condemn private property for public use, and to appropriate ownership and possession thereof for such use upon paying the owner a due compensation. [22:6]

The phrase, eminent domain, appears to have been coined in 1625 by Hugo Grotius in his book entitled The Law of War and

Peace. Grotius stated that "property of subjects belong to the state under the right of eminent domain." [22:6]

The importance of eminent domain to the slurry industry is in the area of right-of-way acquisition. Rights-of-way are an important component in bringing a long-distance coal pipeline to fruition. It is necessary to obtain permits for the crossings of highways, railroads, rivers, streams, and canals. Approvals are required from federal, state and local governments and their agencies for any crossing of public lands and although these approvals were nearly automatic a few years ago, some difficulty has arisen in the past few years as a result of environmental pressures. The effects that environmental policies have had upon access through public lands will be delayed until the section on environmental concerns.

In addition to public permits, pipeline easements are also required for passage through privately owned parcels or property. Most of the requirements for such passage have been met through routine purchase methods, and while with minor exception no problems would arise in the construction of a pipeline, one group of private owners have proven to be a major obstacle in allowing the slurry pipeline builders passage rights. This group, the American railroads, has vehemently opposed the construction and operation of coal slurries. The railroads have historically refused crossing permits to any form of competition. As early as 1874, when the Columbia Conduit System, a Pennsylvania based crude oil pipeline company, attempted to build a sixty-mile line from Millerstown, PA, to Pittsburgh, the railroads have employed this philosophy. A single railroad crossing blocked

the pipeline's passage and the railroad company steadfastly refused to allow the line's completion despite the passage of an 1872 statue which granted the privilege of eminent domain to all common carrier pipelines. The pipeline circumvented the railroad's efforts by building the pipeline to within a few feet of each side of the rail crossing and using a horse-drawn tank wagon to transport the oil across the tracks. By 1875, the courts forced the railroad to give passage and the pipeline was completed [5:44].

Although the preceding story would indicate that small special interest groups cannot block the long-terms needs of the public, the railroads have not ceased in using this methodology to halt competitors. In 1942, the rail industry, despite the country's war-time needs for petroleum, effectively blocked the construction of a number of oil pipelines in various states where the law did not provide the pipeline industry with eminent domain powers. Congress responded with the Cole Act which gave the President the power to give pipeline companies a federal privilege of eminent domain where it was necessary [23:618].

Despite knowledge that its tactics will not indefinitely delay competition, the railroads have persisted in using this old methodology. Its newest competitor, coal slurries, have not been mentioned in the laws of most states or in the federal statues as an industry to which eminent domain has been accorded, therefore the railroads have restricted their passage over railroad properties and rights-of-way.

No doubt the main reason for the railroads vehement opposition is because the product to be carried is coal which has

historically been a product which the rails have been able to virtually monopolize in many areas. Coal has long been and remains today the number one revenue producer for the Class I railroads. In 1977, coal provided $2.7 billion as well as nearly 30 percent of the tonnage originated [24:11].

Because of the preeminent position that coal occupies in its scheme of operations, the railroads through their national organization, the American Association of Railroads (AAR), have mounted a large, well-funded program to oppose the growth of coal slurries on all fronts and according to Bechtel Corporation Vice-President H. M. McCamish, they (the railroads) ". . . are quite frank in saying that they hope to forestall competition." [2:5]

In the absence of rail crossing permits, the coal slurries are effectively limited in their ability to acquire rights-of-way across rail lines to any of three methods: federal eminent domain legislation, state eminent domain legislation, and judicial action. The slurry proponents, in an effort to employ any of or all three of these methods, have united to form their own spokesman group, The Slurry Transport Association (STA), to combat the AAR. The STA is active in lobbying the cause of slurryism in both Washington and at the state capitols of those states where eminent domain is most urgently required. The STA's court activities have been limited to witnessing [25:1].

Despite predating either the U. S. Constitution or any of the original thirteen state constitutions, the concept of eminent domain was not specifically mentioned in any of the early documents although implied references exist as to its tenets in

the Fifth and Fourteenth Amendments. The Fifth Amendment states in part that: ". . . nor shall private property be taken for public use, without just compensation." The Fourteenth states that: "No state shall . . . deprive any person . . . property . . . without due process of law." [26:538]

Whether the oversight of constitutional mention was accidental or by devise can only be speculated. While several interesting theories exist, they are beyond the scope of this study. What can be said is that as the country expanded westward, vigorous road, canal, and railroad building programs quickly brought additional meaning to the concept. Since the power existed strictly as an inherent right of the state and not as a valid act of either Congress or a state legislature, arguments quickly arose and a distinct branch of litigation was created [27:266].

While a growing body of judicial interpretations ultimately guided the application of eminent domain, a number of states began to pass acts which specified the conditions of its use, while other states began to make constitutional provisions for its use. (See Appendix A) Originally, the courts ruled that "public use" literally required the public's use. In the early 1800's, there was a gradual broadening of that concept until "public use" was interpreted as "in the public's interest" by the end of the century [27:266]. Interestingly, eminent domain became synonymous with common carriage since many common carriers became the primary benefactors of its applications in obtaining passageway for their modes [22:7]. As time passed

a number of new industries, unheard of a hundred years ago, have emerged and subsequently they too have been granted the privilege of expropriation. Among them are natural gas pipelines, telephone companies, electric utilities, airports, government interest construction projects, and the like [26:528].

With the re-emergence of slurry technology as a viable mode of transport has come a controversy regarding the use of eminent domain as a means to facilitate its acquisition of rights-of way. Naturally, those opposing the construction of slurries state that the pipelines cannot serve as true common carriers because of the restrictive nature of their customer selection and service. Furthermore, they point out that coal pipelines cannot fit within the context of "in the public interest" as it has historically been interpreted by the courts. Notwithstanding, the proponents of slurries argue that their pipelines can serve as single-commodity common carriers much the same as oil and natural gas pipelines do. In addition, these advocates state that their pipelines are capable of furthering a public purpose and that any private benefit derived from such activity is purely incidental. To advance their argument, the slurry industry in composite fashion formed the STA to:

> . . . encourage the Congress of the United States to extend the right of eminent domain to the coal slurry pipelines so that the public may enjoy the benefits of this economical technology and competition in the field of coal transportation. [25:1]

2. Federal Legislation

At the federal level, legislation to grant eminent domain to the coal slurry pipeline was first introduced in 1962 by the Kennedy Administration. That bill, which would have

triggered the building of a West Virginia to New York/New Jersey pipeline by Consolidation Coal Co. (CONSOL) and Texas Eastern Transmission Company (TETCO), was defeated due to the opposition of a number of powerful eastern railroads who saw their coal transportation monopoly being threatened [28:36]. Not only did the railroads succeed in blocking the Kennedy-sponsored bill at the Federal level, they successfully rebuffed CONSOL and TETCO at the state level, and ultimately bought CONSOL, the developer, builder, and owner of the only active coal pipeline at that time, out of the pipeline business by effecting a massive rate reduction in Coal District 8 on the condition that the Cadiz line cease its operations. Although the rate reduction was obviously in the short-term interests of CONSOL, the railroads' aim was much more farsighted - to stifle the slurry concept [29:34].

And stifle they did; for it was twelve years before another attempt was made for Federal legislation. In the wake of the Arab oil embargo, when the need for this nation to develop its most abundant and cheapest energy resource was most closely highlighted to the general public, coal slurry legislation was once again introduced. In the Senate, Senator Henry "Scoop" Jackson's bill, S.2652, to give slurries condemnation rights was quickly passed on a voice vote. From that time until present, the Senate has been known to be in the slurry camp. Consequently, the fight over Federal legislation has centered in the House of Representatives [5:44].

House activity has not gone well for the slurry industry over these past few years. A 1974 House bill was referred to the

Interior committee, where the railroads were able to obscure the real issue and allow for the bill to die a slow death in committee. The AAR was able to flex its muscles at this time against a rather disorganized group of slurries proponents. While 1975 saw four new House bills and a series of lengthy hearings, the powerful railroad lobby again was able to either kill them or have them tabled while studies were required to gather further information [30:24].

In late 1975, slurry proponents organized to create a full-time lobby, the STA, which would fight the politically-adept AAR. Disconcerted over its dismal results in the House during 1975, the STA moved to hire W. Pat Jennings, the clerk of the House of Representatives, as its president in hopes that his influence would be helpful in overcoming the lethargy found in the House Interior Committee [30:24].

As the debate wore on into 1977, two bills, The Coal Transportation Act of 1977 (S. 1492) and The Coal Pipeline Act of 1977 (H.R. 1609), surfaced as a result of STA instigation. Both were generating more testimony than ever before and both appeared to be quite well-supported [31:6]. Before either bill could pass, the AAR was successful in guiding Senator Lee Metcalf (D., Montana) to request a study by the Congressional Office of Technology Assessment (OTA) before further consideration would be undertaken [31:6]. Unfortunately for the STA, the OTA study took nearly a year longer than was originally forecasted and it was January, 1978, before earnest activity was reinitiated on either of the bills again.

During the interim, a number of interesting and favorable things happened for the STA. The Carter Administration endorsed slurries and urged that the Department of Energy (DOE) be given the power to grant certificates of eminent domain for coal slurries [32:14]. Second, the Interstate Commerce Commission (ICC), fearful of losing control over an area of emergent transportation regulation to DOE, indicated that slurries would be desirable in the West and that it, the ICC, should be granted both certificate and regulatory control over the industry [33:31]. Environmentalists, who had stood unified with the railroads as enemies of the slurries, broke ranks and attacked railroads for their use of unit trains [34:31].

These favorable events, coupled with growing industrial and utility support for coal slurries, made the STA most optimistic about its chances for success in 1978, but eminent domain was not to be. Despite unqualified support in the House Interior Committee and a vote of confidence from the Public Works and Transportation Committee, a rift was opened in the House when the Commerce Committee's Subcommittee on Transportation sought to have the bill referred to it. The Sub-Committee, known to be a bastion of the AAR camp, was refused the right to review the bill on jurisdictional grounds and it subsequently led an attack on the bill which probably caused its defeat on the floor on July 19, 1978. As late as the morning of July 19th, an estimated 100 votes remained uncommitted on the eminent domain question, but the outright opposition of House Commerce Committee's Chairman Harley Staggers (W.VA.), an outspoken railroad advocate, proved devastating. The Coal Pipeline Act was defeated by a 246-161 vote [17:16].

Despite its setback, the STA is ready for another round. Three more slurry bills, H.R. 10663, S. 707, and S. 3046, are presently under review and slurry support is growing day by day. Since the defeat in July, several events and legislative actions have occurred which will heighten the STA's chances for success in the immediate future. First, natural gas price controls have been slightly loosened [35:3039]. Second, coal conversion legislation which highly incentivized the construction of coal-fired utilities and industrial plants and required conversion of many existing plants from oil and natural gas to coal by 1990 was passed [35:3040]. Third, the OPEC countries called for a substantial 1979 price increase [36:1]. Fourth, the flow of Iranian oil has been curtailed for undetermined time [37:1]. Fifth, a number of utilities and industrial concerns have been experiencing extreme difficulties with the railroads during tariff negotiations [2:6].

3. State Legislation

Oklahoma, Texas, and Louisiana all passed legislation granting coal slurry lines the right of eminent domain in their states during their 1977 legislative sessions [38:V]. These three states along with Arkansas, which has a constitutional provision for granting eminent domain, and New Mexico, which has yet to act, had earlier approved a resolution at a Southwest Regional Council meeting of legislative leaders to "urge that slurry pipelines be granted the right of eminent domain as common carriers." [22:11]. This resolution was directed at each of the five legislatures and at the U. S. Congress.

Despite such success, some failures occurred in 1977. Both in Nebraska, where an eminent domain bill died in committee, and Kansas, where a bill was defeated, the slurry proponents must regroup and try again. New legislation has been introduced and is presently pending in each of these states. Despite vigorous opposition, passage appears likely in both Nebraska and Kansas in the near future [2:7].

The bulk of the present efforts to obtain eminent domain rights on behalf of slurries are being taken in the Far West because all of the currently planned projects have been announced for that area; however, earlier proposals had already caused some legislative activity in the East. The Cadiz Line tested a 1952 Ohio law which had given slurries passage rights in that state [22:10]. The proposed West Virginia line of the early 1960's brought positive legislation in West Virginia in 1962, but at the same time it cost slurry adovcates in Virginia where an existent law which provided eminent domain authority was amended at railroad instigation to specifically disallow the exercise of the authority by coal pipelines [39:124; 5:44].

The issue of eminent domain never arose in regards to the Black Mesa Pipeline, owned oddly enough by a railroad company, the Southern Pacific. Several reasons may exist forthis break in character. First, the Black Mesa mines are located over 100 miles from the nearest railhead and, secondly, because the mountaineous terrain that the pipeline covers is not considered suitable for rail construction, the pipeline is not considered to be a direct competitor of the railroads [22:13].

As the scoreboard presently stands, there are ten states which have definite legislation to grant expropriation rights to coal slurries and another nine have enactments that probably would support grants in their respective states, although judicial tests would be required in each [2:7]. The number of states supporting slurries becomes incidental, though, when an examination is made as to the locational aspect of the states to the subject pipelines. Slurry advocates have fought specifically to secure legislative support in those states concentrated along the routes of the planned pipelines. Exhibit 10 depicts those states which presently support slurry legislation.

It is now possible to see that many of the pipelines can now or will be able in the near future to begin construction without fear of right-of-way entaglements. For example, the shorter of the two Alton Lines could be built entirely within Utah, while the longer one would have only a short 18-mile run into Nevada, which might not present any problems since the Black Mesa was able to transverse it successfully. The San Marco has complete eminent domain coverage for its long distance line, although its feeder line from New Mexico would remain questionable without some action. The Wytex could be built by use of a Colorado corridor. The ETSI also could use a Colorado route, but that is unlikely since ETSI has now established its route through Nebraska and Kansas by use of the court system. Of the two remaining pipelines, the Northwest proposal is relatively inactive and therefore state legislation was not sought; and the Florida proposal has still not announced its route. If and

EMINENT DOMAIN FOR SLURRIES

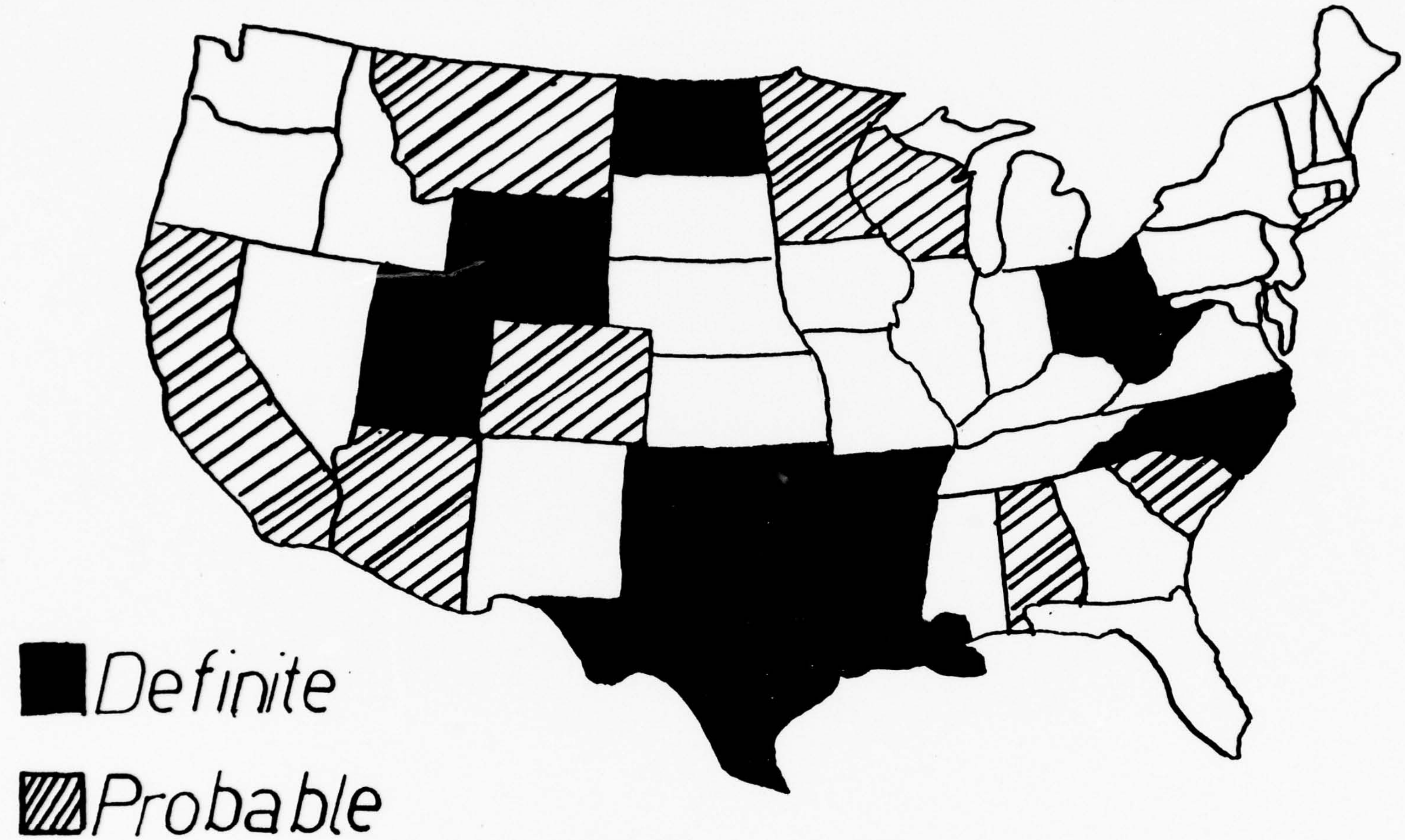


Exhibit 10

when the selected route is announced, some aggressive action to secure rights-of-way will be undoubtedly required.

4. Judicial Decision

To date, only one coal slurry line has sought to use the judicial system to strike down its opponents. That line, the ETSI, has persistently challenged the legality of railroad impediments along its entire route. In setting a precedent in July 1977, U.S. District Court Judge Clarence A. Brimmer (Wyoming) ruled that ETSI's line could pass under the Union Pacific's tracks despite the railroad's claim that the 1862 Pacific Railroads Act gave it control over the subsurface of its 400-foot rights-of-way. Brimmer disagreed with the railroad, stating that the rights pertaining to the substructure remained with the Federal government [16]. Since the Brimmer decision, which ETSI hailed as a significant step forward, the pipeline company has won 66 more cases involving railroad obstruction. From a right-of-way perspective, the ETSI is presently prepared to begin construction [17:7].

B. ENVIRONMENTAL CONCERN

Environmentalism, born of fear in the late 1950's, became an issue of resounding public sentiment in the late 1960's. Alarmist tendencies, whipped by the environmentalist movement, made the state of the environment an issue of popular concern. Membership in both older clubs, such as the Sierra Club, and newer, more militant groups like Friends of the Earth was increasing. In response to growing concern, Congress established the Council on Environmental Quality (CEQ) within the Presidnet's Executive

Office in 1969 to study the state of the environment and recommend a course of action to be followed in upgrading it. In 1970, the CEQ laid out an extensive environmental agenda, which when articulated by President Nixon established 37 goals for his administration [40:101].

At the turn of the decade, environment was synonymous with politics. Not only was President Nixon attempting to capitalize on the synergistic effects of the movement, but so was Senator Ed Muskie, the leading Democratic candidate for the Presidency. Muskie was an outspoken proponent of "Earth Day." Held April 22, 1970, Earth Day was set aside to demonstrate that millions of Americans were upset about environmental degradation. Acclaimed by its proponents as a hugh public relations success, "Earth Day" brought the widest media coverage to the environmentalist movement that it had ever enjoyed [40:101].

Riding the crest of their movement, environmentalists continued to force change throughout the first of the early 1970's. The Environmental Protection Agency (EPA) was created in October 1970, under a Presidential Reorganization Plan approved by Congress. EPA's creation centralized nearly 6000 employees from fifteen other agencies to coordinate America's attack on pollution. In unifying the forces for research, monitoring, standard-establishment, and enforcement, it was thought that the EPA would become America's guardian of the environment, a watchdog to ensure that pollution control would become an integral system in the American Scheme of Life [40:102].

Six areas of pollution control were placed under the jurisdiction of the EPA through various legislative mandates and

nearly all of these areas have had an impact, either directly or indirectly, upon the proposed coal slurry pipelines. These areas are water pollution, air pollution, solid waste, pesticides, radiation, and noise. In addition to these general areas, a number of other lesser concerns have been aired because of either the persistent efforts of naturalists or the requirement for full disclosure of environmental impact whenever a project is proposed under various state and federal statues [40:102].

The primary piece of legislation affecting industry is the National Environmental Policy Act (NEPA) which created the CEQ in 1969. Although much amended, this act provides for the basic framework under which environmental policy is established and how it is administered. It specifies the procedural steps in submitting data for Environmental Impact Statements (EIS). As stated earlier in regards to Alton pipelines, EIS data submission is a sensitive issue not only to the coal slurry industry, but also to the utility industry as well [41:133] In fact, last June 14, when the EPA announced that a plan from Montana Power Co. for the construction of two coal-fired plants was being rejected because the utility had not used more advanced pollution-control equipment, the utility was appalled because the standards requiring this action had only been authorized under the Clean Air Act of 1977 while the submitted plans were much older [42].

Because legislation at the Federal level has preemptive authority over the statues of any state under the supremacy clause of the Constitution, this discussion will parallel Federal

Law, although it is worthy of note that many states, especially those in the Rocky Mountains, the Northern Great Plains, the Great Southwest, and to a lesser extent the Southeast, also have quite rigid statues which in many cases, because of their more restrictive nature, take precedence or at least dominate the action of industrial suitors [43]. For example, in Montana, a series of laws restricting the use of water for energy development, prohibiting entirely the disposal of certain effluents in any manner, and severely regulating the strip-mining of coal have been passed in the past five years [44].

The Clean Air and Clean Water Acts of 1970 and 1972, respectively, jointly sponsored by Senator Ed Muskie (D-ME), provided that the EPA establish, monitor, and enforce air and water quality standards and emission or discharge regulations throughout the country. Under the air mandate, the country was divided into several regions for air quality, and standards were set depending on the pre-existent quality of air in each of those regions. Similarly, regions were required for the improvement of water conditions not only by the 1972 Act but also by its precursors relating to water quality in 1962 and 1965 [41:130]. Both the Clean Air Act of 1970 and its companion, the Clean Water Act of 1972, were updated in 1977 by the Clean Air and Clean Water Acts of 1977. These subsequent amendments generally stiffened the EPA's stringent requirements for industry to achieve; however, both Acts expanded the time-frames for absolute compliance with the toughened standards [45:4; 46:2].

The Clean Air Act of 1970 had a general debilitating effect on the coal industry. An industry-wide slump was in progress at that time of its passage and that slump continued into 1971 [47:19; 48:72]. The tight regulations set by the EPA with regard to sulfur pollutants created an immediate problem for all coal users. Electric utilities which derived 80 percent of all generating capacity from coal-fired units at that time suddenly found that coal was an environmental public enemy [49:I-5-1]. In New York City, the Mayor-elect, John Lindsay, stated his administration would seek to ban the use of coal by Consolidated Edison Co. (ConEdison) which used coal to provide for 40 percent of the city's requirements [50:22].

As utilities began to turn away from coal, rather than try to attempt to meet the EPA standards, nuclear generation increasingly became the answer. Originally scheduled only to double from its 1964 capacity of 100 megawatts (mw) by 1970, nuclear generation exploded to 98,520 mw of capacity and forecasts were revised to indicate another doubling of 1970's capacity by 1980. The revised 1990 estimate called for 475,000 mw according to the Federal Power Commission (FPC). The Atomic Energy Commission (AEC) exhibited more optimism in stating that capacity would be 500,000 mw [49:I-6-1). In essence, nuclear generation began to supplant coal as the fuel of the future. The FPC estimated that by 1990 coal generation would account for only 44 percent of power requirements and most of that capacity would be from the existing plants that abound today [49:I-5-1].

While the preceding projections appeared to be holding true for the first five years of this decade, the ficklefinger of

environmentalists twitched about until it came to rest on the dangers of the nuclear energy. During the interim between coal's turn on the environmentalist hot seat and nuclear energy's, this nation had endured both the Arab Oil Embargo of 1973 and the natural gas shortage of 1975. The Federal government had turned its crisis mentality from the environment to a new and growing monster, the energy crisis. New headlines pervaded the media; although environment was not a forgotten subject, it was second page news. After all, the quality of both the air and water was dramatically improved. According to Senator Muskie, "90% of the nation's industries" were on target in meeting federally imposed standards for water discharges [45:4]. The EPA even proposed the softening of pollution rules for all but the largest industries [51:2]. Likewise, the quality of the air was much improved, such that talk of simultaneous coal development and environmental strategies was virtually unopposed by the major environmentalist lobbies.

As this trend took hold, the Carter Administration began its long fight for a National Energy Bill. The Department of Energy (DOE) was created and the "moral equivalent of war" was declared by President Carter [52]. The National Energy Plan (NEP) proposed by the administration called for a doubling of the coal production by 1985. America's route to energy independence, at least in the short-term, was to be coal development [53:63]. Although this policy was endorsed by several studies, most notably those of the National Petroleum Council, the Workshop on Alternate Strategies, and Project Independence, a grassroots movement, was needed to overcome the political realities of

overt environmentalism [54; 55; 56].

On March 2, 1977, the Department of Energy (DOE) published a notice in The Federal Register requesting the comments of the general public on the issues of: (1) prioritizing various energy development options; and (2) ranking of those development options in relation for their potential to cause environmental harm. A total of 27,898 responses (18,721 from individuals and 9,177 from groups) were received and the summarized results are shown in Table II. This public opinion poll ranked coal as the most favored option for energy development and also showed that nuclear development was far and away the most feared form of development from the standpoint of its potential for damaging the environment [57:26/7].

The published results of DOE's Public Opinion Study revealed several anomolies when compared to the recent past. Using Exhibit 11 created from data in the DOE study, which presents a composite review of the various states' relative strengths either in support of or against strong environmentalist stands relative to energy development, it is found that in both Kansas and Nebraska, where environmentalist concern has led to the defeat of eminent domain legislation, that the DOE response statistics indicate the populace is in theory aligned with the energy development camp. Conversely, in the Rock Mountains, the Southwest, and the Southeast, where the pro-coal energy forces are headquartered, the DOE study revealed paradoxical information. While these truisms may be indicative of a general bias found in the DOE survey, it is probably more likely that a specific bias occurred in which the number of responses and the magnitude of their support either

TABLE II

RESPONSES TO DOE QUESTIONNAIRE

IN RESPONSE TO THE QUESTION: WHICH OF THE FOLLOWING ENERGY SOURCES PRESENTS THE GREATEST RISK TO THE ENVIRONMENT? [57:26]

	1	2	3	4	5	6	7	8	9
COAL	2	2	2	2	2	2	2	2	2
OIL	6	5	3	4	3	3	2	4	4
GAS	8	7	4	5	3	3	2	4	4
NUCLEAR	1	1	1	1	1	1	1	1	1
HYDROELECTRIC	5	4	3	5	3	3	2	3	4
SOLAR	3	3	4	3	2	3	2	3	3
GEOTHERMAL	7	6	3	4	3	3	2	4	4
OTHER	4	5	3	4	2	3	2	3	4

IN RESPONSE TO THE QUESTION: IN WHAT PRIORITY SHOULD THE FOLLOWING ENERGY RESOURCES BE DEVELOPED? [57:27]

	1	2	3	4	5	6	7	8	9
COAL	1	2	1	1	2	1	1	2	1
OIL	5	5	5	5	5	6	8	6	5
GAS	7	8	6	7	8	7	7	8	8
NUCLEAR	2	1	2	2	3	3	3	3	3
HYDROELECTRIC	6	6	5	6	6	4	4	5	6
SOLAR	3	3	3	3	1	2	2	1	2
GEOTHERMAL	8	7	7	8	7	8	6	7	7
OTHER	4	4	4	4	4	5	5	4	4

COLUMN DESIGNATIONS:

1. CONSENSUS
2. GENERAL PUBLIC
3. BUSINESS
4. INDUSTRY
5. PUBLIC INTEREST GROUPS
6. GOVERNMENT
7. LABOR
8, EDUCATION
9. OTHER

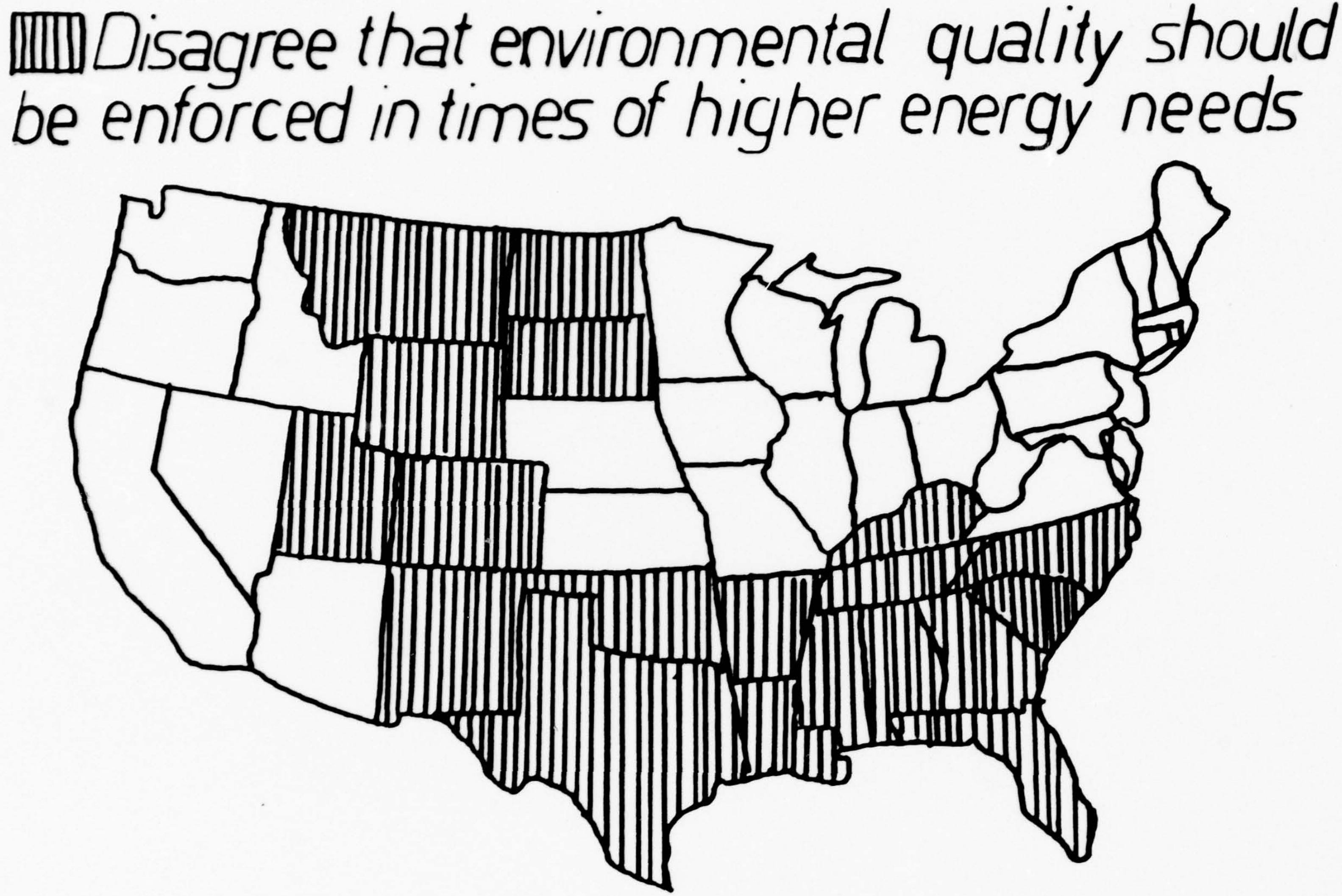

Disagree that environmental quality should be enforced in times of higher energy needs

Exhibit 11

for energy development or for environmental protection was largely a matter of the perceived imminence that the respondents felt toward the possibility of either of these developments affecting their particular regions.

While the EPA has guarded the public from pollution, the DOE, through its Energy Research and Development Agency (ERDA) has been tasked independently to explicitly develop a number of new energy options and the means to transport the energy. While these goals appear to be in conflict, ERDA has as a primary goal, the development and commercialization of any and all of these technologies in such a manner as:

> . . . to protect and improve the Nation's environmental quality by assuring that the preservation of land, water, and air resources is given high priority. [58:5-1]

In support of the coal option, a supporting technology field which ERDA is attempting to develop has been fossil fuel transportation. This generic area contains a number of options including coal slurry pipelines, railroads, barge, and extra high voltage (EHV) transmission [58:5-7].

With the emphasis back toward coal as a major fuel, coal slurry lines have taken on additional meaning as a viable mode of transportation. Due to the anti-coal attitudes of the early 1970's, there was little interest in supporting the emergent slurry proposals; but with the resurgence of interest in coal, a heightened level of attention to slurries has been observed. Among the interested are the environmentalists because slurries appear to be more environmentally sound than some of the other transportation options. Despite the appearnace of a developing

relationship, the environmentalists and slurrymen remain far from friends because a number of questions remain to be answered conclusively.

While a number of utilities had turned to Western coal as a means to meet the EPA imposed standards of the Clean Air Act of 1970, the 1977 amendments to the Act effectively prohibited these actions by requiring that all power plants employ the latest available technology in meeting the standards [59:2]. The EPA followed this action by tightening its air quality emission standards by 85 percent in September of 1978 [60:12]. However, the EPA noted some modifications could be made to relax this requirement for plants using low-sulfur western coals [61:6]. EPA'S tightening of its standards, under the auspices of best available technology, followed significant advancements in scrubber technology [62:8]. Scrubbers, devices to clean sulfur pollutants from coal emissions, have evolved significantly enough to eliminate 85 percent of the pollutants from high-sulfur Eastern coals, although it has yet to be shown that it can economically be applied to plants using low-sulfur coal which the proposed slurries would transport. [61:6]. Another technology which appears to be influencing the EPA's action is the development on two new portable spectrometers by the Naval Research Laboratory (NRL) to determine the amount of sulfur pollutants in the atmosphere and the degree of existent health hazard derived from those pollutants [63:8].

The demand for low-sulfur coal has caused 17 states and several Canadian provinces to begin using Wyoming coal. Predictions call for another eleven-fold increase in its use by the

year 2000 [64:79]. Since the railroads in that area are nearly 100 percent utilized at present, and barge use is impractical because of the lack of navigable waterways, other options have been explored. Although EHV transmission networks have been considered a plausible option, they also have been considered unduly expensive, while the slurry options have been warmly received by both coal producers and users of Wyoming and other Western coals [65:11].

The slurry advocates, dormant for a decade, had come back in the mid-1970's with proposal after proposal. Although the previous section on eminent domain indicated that the railroads had attempted to delay slurry construction, it should be noted that the environmentalists through the EPA, have actually slowed slurry activity as much as any group. Although the effects are inadvertent, a number of Federal statues have proven to be major hurdles for slurry projects. The National Environmental Policy Act (NEPA) requirements for providing environmental impact data have become a time-consuming ordeal. In fact, if the protracted delays that Nevada Power have reported regarding the Alton Lines is indicative of the future, then any new slurries will be significantly affected by NEPA, because slurries cannot avoid EIS. Under the NEPA, EIS is required for projects which: (1) cross Federal lands; (2) cross "waters of the U.S."; (3) discharge pollutants into waters; and (4) are part of the transportation element of a Mine Plan for the development of a Federal Coal lease [38:133].

Impacts considered by NEPA include both those created by construction or operations. Some of the more notable construction

impacts are: (1) disruption of fish migration paths while streams are diverted for construction purposes, (2) destruction of habitat for ecosystems due to vegetation removal during construction, (3) increased dust due to traffic of construction equipment, (4) increased fire hazards due to presence of man, (5) aesthetic value of the land is temporarily reduced, (6) noise increased temporarily, (7) possible erosion hazards created because of land cuts to meet grade requirements, and (8) recreational activities could be disrupted. Operational impact on the environment is generally caused in only one way by a coal slurry line, and that is due to rupture. Even a small leak at the high pressures used in slurry technology will quickly develop into a major break [41:109-114]. Because only one such rupture has ever occurred, the effects of such spills can only be speculated since knowledge regarding that spill is limited. While it is known that the quantity of the spill would depend upon the flow rate, pressure, depth of the pipe, characteristics of the overburden, time of the detection, etc., speculation can only be offered as to the environmental effect. It is believed that damage to the environment resulting from a spill would not be severe, although the effect of the coal sludge on plant growth or aquatic life cannot be projected. An immediate concern in any spill would result if toxic corrosion inhibitors are being used to protect the pipelines. Some chemical additives could poison animal life or contaminate community drinking waters in the event of a spill [66:16].

The potential for industrial spills into "waters of the United States" has prompted the enactment of two laws. The

first, the Federal Water Pollution Control Act (FWPCA), prohibits the accidental or purposeful discharge of any industrial effluent which may contain toxic or hazardous substances into the surface waters of the United States without a permit. Likewise, the Safe Drinking Water Act (SDWA) protects underground sources by eliminating the use of either underground injections or unsealed dump ponds as methods for liquid waste disposal when the waste contains either toxic or hazardous substances [41:130]. Violations of either of these laws carries a substantial penalty for both the offending corporation and its officers. Although neither of these laws has caused any concern to date, the potential for conflict abounds because of the Clean Water amendments of 1977. Essentially, that legislation adds a provision for new non-conventional pollutants to be categorized by the EPA and added to its toxic or hazardous substance list. Such additions could cause an impact for coal slurries, since coal is known to carry a multitude of organic riders which may be leached by slurry effluents [66:16].

Slurry effluent at the Black Mesa complex is presently being used as makeup water for the cooling tower at the Mojave generating plant. The effluent is cooled, settled, treated, and then mixed with five parts fresh water before being consumed at the cooling tower. All the effluent has been effectively used with no proven environmental impact. It is considered feasible that this type of system will be employed at the utily termini for all the presently proposed slurry lines [67]. If slurries are eventually built to service coal exporting terminals or industries which would not use large cooling towers, then some

rethinking on effluent usage will be in order [68:10].

While the detractors of coal slurry lines point to its use of scarce water (discussed in section 4 of this chapter), its damage potential if a spill were to occur, and its temporary construction impact, the slurrymen scoff and point with pride to their record. The Ohio and Black Mesa pipelines have provided 16 years of operational experience and no evidence of environmental impact can be shown. The lines are buried, quiet, and present no air, water, or radiation hazards. There is no fire danger nor is the slurry in itself considered toxic. Slurrymen note that none of the other modes of transportation can match it [69:5.23]. ETSI, purveyor of the most controversial pipeline, usually pairs the social ills of rail lines with its environmental arguments by advising people that its pipeline would replace 2500 unit trains of coal each year or one every hour and fourty-five minutes, day and night, 365 days per year [70:8]. In a small town like Lusk, Wyoming, that type of talk is understood. There the town is bisected by one of the two main lines running out of the Powder River Basin coal fields and it is predicted that during the 1980's at least 50 units trains per day will cut the town in half. Every half-hour, day and night, trains averaging 100 cars in length will rumble through the town with all of the attendant social problems of trains [71:12].

The "environmental issue" appears to be one that the coal slurry has in hand. The big problem in the environmental area is to ensure that coal remains a powerful energy alternative, since previous research has already shown that coal-fired power plants present a significantly more serious threat to the

ecological subsystems around them than do either unit trains or coal slurry pipelines [72:24].

C. THE RAIL SLURRY COMPETITION ISSUES

The American railroad industry has been the enemy of coal slurry pipelines from the first day that the Cadiz line proved successful. CONSOL had originally begun the development of slurry data to combat the rising cost of rail transport. During the course of CONSOL's efforts, the railroads, among others, looked on with interest. The futility of CONSOL's project was widely recognized and probably best summed up by a Coal Age magazine article in 1951:

> . . . for a good many years to come, the bulk of coal shipments will doubtless continue on moving by rail - not because it is cheaper - but because it would take a long time and lots of money to build another transportation network that would equal the railroads. [73]

Notwithstanding such ominous forecasts, CONSOL persisted in its investigation until in 1957 four of its researchers patented a coal slurry transport system [74]. Within a year, the Cadiz pipeline was in operation and the local railroads were feeling its effect. Competition required action, and as previously stated, the railroads responded with significant rate concessions to force the retirement of the pipeline [75:92].

The rail industry has not forgotten the lesson of competition from Cadiz. The lesson brought back many of the bitter memories faced by the industry during its decline in the twentieth century [76]. First, the pipelines and water traffic had cut into rail revenues, then it was the motor industry, and finally air transport had done its damage. The rail industry,

through its organized voice, the American Association of Railroads (AAR), was determined not to be humbled by another competitor - at least, not without a fight [31:20].

The struggle between railmen and slurrymen has now worn on for over two decades. Their disagreement has been multifaceted, and as noted in the background chapter, there have been substantial differences of opinion even as to matters of fact. An area rich in conflict has been the one involving the supposed impact of slurries upon the railroads. This area is quite pervasive because a large number of sub-issues provide its structure. Because the sub-issues range from conflict over which mode uses the most energy to which one most gainfully employs steel, this discussion must necessarily be limited to the most basic sub-issues. The following issues will be examined: (1) the issue of need, (2) the competition issue, and (3) the economics issue.

1. The Issue of Need

Ever since President Carter's call for the doubling of coal production on April 20, 1977, there has been a considerable amount of speculation as to whether or not the coal industry could respond to such pressures [77:15]. Only the General Accounting Office (GAO) emphatically stated that attainment of such a lofty goal was impractical and unlikely [69:1]. A great number of other projections have indirectly refuted the President's projection by quoting lower production estimates through 1985. While no consensus of opinion exists as to how many tons of coal will be produced, it is hypothesized that the actual amount would fall somewhere between the Edison Electric Institute's estimate of 779 million tons and the Bureau of Mines' approximation

of 988 million tons [69:ii]. Using these estimates as the practical upper and lower bounds of coal production, an issue of conflict has arisen over whether slurries (or other modes) are required or whether the railroads can handle the increased traffic requirements. This sub-issue is the issue of need.

Even under a reduced scenario, a question exists as to the railroads' ability to handle the higher traffic demands. Historically the railroads have been a capital intensive industry. When cars were short, more were purchased. Because of the relative ease with which cars were added, the railroads accorded only lip service to complaints regarding car shortages [78:2]. Whenever complaints were severe, the railroads' ploy was to introduce a new nation-wide system which was to solve the problems. First, there were car service rules, then per diem systems, and finally Automatic Car Identification (ACI). None of the systems worked. In the recent past has come the Train II system, but despite its sophistication, car shortages persist. The rail industry explains on the one hand that despite the best of systems, localized car shortages are apt to occur; yet on the other, the industry insists that they have no problems in meeting the expanding requirements of the coal industry [66:18]. The National Coal Association (NCA) has taken umbrage with the AAR's thinking. According to its President, Carl E. Bagge, the coal industry requires slurries. He adamantly contests the railroads' ability to keep pace with expanding coal production, stating that:

> Long haul coal movements of western railroads have shown that a minimum of 4000 coal cars are required to move 25 million tons of coal under the unit train concept. With the minimum potential increase in coal of 300 million tons of coal over the decade, the railroads will need an additional 48000 cars and 2400 locomotives. In addition replacements to maintain their hauling capacity, they will require 39200 more hopper cars and 1960 additional locomotives. With the aforementioned financing problems, the NCA doubts that the railroads can keep pace to 1985, let along beyond that period in time [79:31].

A growing number of utilities have found that the only way to ensure that the railroads will have cars for their unit trains is to buy and maintain their own cars. Pennsylvania Power and Light (PP&L) pioneered the use of privately-owned cars for unit train operations in 1963 and since that time the concept has grown tremendously. At least 25 utilities are now employing well over 16,500 owned or leased cars [80:29]. Because Houston Lighting and Power, Portland General Electric, and Wisconsin Electric Power have all placed recent orders totaling 1782 cars, it is anticipated that the use of prinvately-owned cars will continue to enjoy expanded use [81:30].

Despite the lack of optimism demonstrated by the users of rail transport, a number of studies have indicated that the railroads can handle the predicted growth. The Bureau of Mines confirmed that "the capacity of the railroads to cope with substantially more western coal does not seem to be an unduly serious matter." [82;19] A study performed by Hudson Institute noted that:

> Railroads should be able to meet initial requirements with little effort and, given investment in cars and motive power, should be able to increase haulage as fast as mines can increase production. [83:36]

A study prepared for the Federal Energy Administration by Peat, Marwick, and Mitchel indicated that the rail industry would have no difficulty in acquiring the equipment it needed under any of three different scenarios, one of which assumed a far greater coal production that has now been anticipated [84:vii]. A report prepared for the Department of Transportation (DOT) predicted that "anticipated coal traffic increases, even though affecting individual railroads unevenly, would not place (an) unmanageable strain on rail capacity." [85:45]

Unfortunately, there are no official comprehensive estimates of railroad network capacity from which judgments can be made. While all of the above studies adjudge the adequacy of the rail system to be sound, other studies can be found to refute them. A study prepared for the Federal Railroad Administration states:

> The ability of rail lines to absorb considerable increase in traffic without major change must be questioned. Line capacity was found to be considerably less than widely believed. . . Delays generally exceed acceptable limits. . . [86].

An Electric Power Research Institute (EPRI) report states:

> Based on our estimates . . . we have found that there are a number of critical locations on the railroad network which cannot handle the projected 1985 traffic. In a sentence, for many public utilities, which may be dependent on coal by 1985, there is legitimate concern that the transportation system (all modes) may not be able to carry the coal over the most direct, lowest cost routes. [87:71].

These last two references are the type which catch the eyes of coal primaries, suppliers and users. A number of primaries believe that railroads cannot cope with the future alone.

Among the primaries so inclined are the National Association of Electric Companies, the Rural Electric Cooperatives, and the American Public Power Association. Without a continuous, uninterrupted flow of coal, public utilities know that their future operations will be jeopardized. It is in their best interest to look for secure modes of transportation and in great numbers they are turning to coal slurry pipelines. The National Coal Association, the suppliers, and public utilities, the users, all appear to realize that the issue of need is settled in favor of coal slurry pipelines.

2. The Competitive Issue

"Competition is the spice of life," goes an old adage. In America, it has become a way of life. Competitive rivalry is no stranger to the transportation industries; in fact, it aided the rail industry in establishing itself. The story of The Tom Thumb, Peter Cooper's little engine, racing with a small grey horse from Ellicott's Mills to Baltimore in 1830 is probably as well known today as when it first happened. Had it not been for the Tom Thumb's performance, a railroad network might not have evolved as early as it did in this country [76:2]. Despite the importance of competition to the railroad's past, they now question its morality when used againsta regulated industry.

Somewhere the spirit of competition has become a dead virtue in rail transportation. Whether it happened to the railroads during the cartel period, the trust era, during nationalization, or since the depression can only be speculated. The fact is that the competitive nature is no longer there. Today, profit

margins, rates of return, the building or the abandonment of lines and countless other areas are all regulated. No deviations are tolerated; cars are traded, rates are joined, and tracks are shared. Internal competition just has not proven to be the spice of railroad life and it appears that the railroad industry is just one big happy family.

Many believe that the construction of coal slurry pipelines would stimulate the railroads' interest in providing better service and in reducing price. In an editorial, the Tulsa Tribune stated that "Transportation that costs more than it needs to cost is a tax against the ultimate consumer." Craig McNeese, the Vice-President of Houston Lighting and Power (HLP), testified before the Senate Subcommittee on Public Lands and Resources on May 25, 1978, that:

> We believe that the situation (high rail tariffs) faced by HLP could be entirely different were there a viable coal slurry pipeline industry in operation today. For coal slurry pipelines would provide (for) an alternate form of transportation that at the very least would create a <u>competitive incentive</u> for the establishment of more <u>realistic rates by the</u> railroads. [88]

The rail industry rebuts their critics by claiming that competition does exist. They claim that they compete as well as cooperate with other railroads and barge lines. According to a Burlington Northern (BN) pamphlet on competition:

> Utilities and other major coal users have a choice of suppliers as well as carriers. This vigorous competition will remain as long as the present modes and mines are not shut out by coal slurry pipelines and their long term take or pay contacts. [89]

The President of the AAR, William Dempsey, adds, " . . . railroads are true common carriers." The railroads cannot set

rates arbitrarily and declare that their customers must accept the rates or do without service. The customer has the right of appeal to the Interstate Commerce Commission whenever it senses that a railroad has set an unfair rate [90].

While the railroad community can point with alacrity to such statements, there appears to be little substance to their promises of choice. For instance, in the now famous San Antonio rate case, BN quoted HLP a rate of $7.90 a ton to move coal from Gillette, Wyoming, to San Antonio subject to annual adjustments. Subsequently, HLP signed a twenty-year agreement with its suppliers whereupon it was notified by BN that because of an unprecedented increase in costs, a charge of $11.37 would be required. These charges were then adjusted upward to $11.94 in November, 1978. HLP appealed, ICC Docket #36190, and the rate was subsequently reset at $10.93, whereupon BN sued the ICC. Although the 8th District Court of Appeals refused to hear the case, the issue did not stop. BN filed for a new increase to $18.23 per ton which was contested before the ICC by the HLP. Subsequently the rate was reduced, but not enough to satisfy HLP which filed suit for further relief [91]. A similar case involving BN and HLP has also developed over the rates between Gillette and Houston [92:3].

In a speech to Congress in 1977, President Carter stated, "I happen to believe in competition, and we don't have enough of it right now." In regard to transportation alternatives he is probably right, however one degree of consideration must be made in the railroads' case. As a common carrier, it could not challenge a coal pipeline with its long-term contract coverage.

Through the use of a long-term "take-or-pay" contract, the slurry effectively locks up its customer for 20, 25, or 30 years. President Dempsey of the AAR says: "No railroad can win back the traffic lost to a pipeline. . . not by cutting rates, not through innovations, not by any means. There cannot be competition when the so-called competitors operate under different and unequal rules." [90:7]

3. The Economics Issue

During the period from 1925 to 1970, the electric power industry was able to decrease electric rates to residential customers by 70 percent while the consumer price index rose by nearly 500percent. This remarkable performance on the part of the utilities was due mostly to their improvements in efficiencies while the price of fuel remained stable. Since 1970, the pace of technological advancements have slowed and fuel costs have soared. Utilities have sought ways to reduce fuel costs and many have looked squarely at their transportation costs which have run as high as 70 percent of the delivered cost of fuel. For this reason, a number of utilities are hailing the use of coal slurry lines as essential [2:11].

According to the Congressional testimony of F. W. Lewis, President of Mid-South Utilities, he expects to save and pass on to the consumers of the area served by the ETSI pipeline a savings of $14 billion over the next 30 years [93:37]. Similar testimony from Howard Cowen, a former Vice-President of the Oklahoma Public Service Corporation, indicated a $12 billion savings could be delivered in his home state if the Wytex Line was operational today [34:32].

Although a number of studies have been performed to demonstrate that neither of the two methods can be considered unequivocally superior in all instances to the other, several general advantages can be noted in the slurry's favor. First, it offers a definite economy of scale benefit. They are economically efficient for moving large volumes of coal over long distances for long periods of time. This advantage has been passed to the consumers served by the Mojave Power Station which is supplied by the Black Mesa Pipeline. Officials of Southern California Edison estimate that they have saved and passed on to their customers nearly 50 percent of the cost that would have been required had they taken the rail alternative. [77:3] The second general advantage enjoyed by slurries is their capital intensiveness. Once the pipeline is installed, 70 percent of its cost remains fixed for thelife time of the line. By contrast only 50 percent of the rails' costs are fixed. For this reason, the pipeline remains relatively insensitive to escalation from inflation and most customers prepared to sign long-term contracts are extremely happy with such an inflationary hedge [77:3].

As previously mentioned, a number of studies have drawn upon hypothetical cases to show that in some cases rail is superior from a cost standpoint to slurry. Likewise, a number of studies show that on an equal basis, slurry is superior in certain cases to rail. Most studies, however, are inconclusive. The notable and recent study of the Office of Technology Assessment (OTA) declared where rail lines previously existed, the rail option is often superior and where the distance becomes a factor, the slurry

tends to dominate [41]. Unfortunately, none of the current studies have attempted to analyze the situation which existed shortly after construction of the Black Mesa Pipeline (BMP) and the Black Mesa and Lake Powell Railroad (BM&LP). Although the BMP and the BM&LP were not direct competitors, they represent the only real comparable sets of data that presently exist. While only a crude comparison can be made, its importance is significant since it can be abstracted from actual rather than hypothetical data [94:69].

BM&LP was a 78-mile rail line built between Black Mesa and the Navajo Generating Station near Lake Powell on the Arizona-Utah border. Designed to operate automatically, BM&LP was to remain in constant motion 24 hours a day, six days a week. The computer-controlled line employed the most advanced rail technology available in 1974. Its rails were continuously welded, its ties were of concrete, and its cars were especially designed over-sized, bottom-dump models that enhanced the rapid delivery capabilities advertised by its builder, Morrison-Knudsen. The unmanned engines were to pull the trains at approximately 25 MPH between Black Mesa and Lake Powell, slowing only at terminals to allow for loading and unloading at one-half mile per hour. After gliding through the terminals, the trains would again speed on towards its next destination. The total cost for the BM&LP system was slightly over $54 million.

The results of the BM&LP experiment indicates that the train's automatic controls failed and that a three-man crew was required to manually override the computer-operated systems.

The concrete ties began to chip and crack under the tremendous weight of the oversized 122-ton cars. In an effort to decelerate the rate of wear that it was enduring, the BM&LP reduced the load factor for its cars by 25 percent. Although the railroad attempted to sell the cars, there were no takers. According to H. C. Voepel, the Assistant Superintendent of the Navajo Plant: "Looking at the economics of pulling all that dead weight, you could justify throwing the cars away." [94:69] Ultimately, that action was taken and 100-ton cars were purchased to replace the oversized ones. Minimal repairs were made to the trackage at a cost of $10 million even though Morrison-Knudsen Co. stated a $20 million overhaul was needed to replace the concrete ties.

To formulate a rough comparison, consider that the BMP at 273 miles in length carried 4.5 million tons of coal in its first year or a total of 1228.5 million ton miles at a total capital cost of $39 million plus operating costs. Meanwhile, the BM&LP carried 90 tons of coal per car, 100 cars per train, 3 times per day, six days per week over a 78-mile course, for a total of 657 million ton miles at a cost of $64 million plus operating costs. Even if operating costs were considered to be equal, which they probably were not considering BM&LP problems, then the slurry exhibited a .0317¢/ton mile compared to .0974¢/ton mile advantage over the BM&LP railroad. Another advantage enjoyed by BMP as well was the near perfect material condition of its pipeline in comparison to the damaged condition of the railroad.

D. WATER USE

Of all of the issues affecting coal slurries, probably the most emotional one is water. A rather new Wyoming adage, "Water tends to flow in the general direction of money," cynically refers to the state's granting of a provisional water permit to ETSI in 1974. The permit would allow ETSI to use up to 20,000 acre feet of water per year from the Madison aquifer for the next thirty years. Many people, including a number of South Dakota residents, were extremely perturbed over Wyoming's action. William Janklow, then Attorney General and presently Governor of South Dakota, said that, "The water belongs to everyone, but he who gets there first should have first crack at it. Our communities and farmers have been here for years. . . " [95:Al]

One would hope that emotion would not guide the decisions which could inevitably effect the lives of countless numbers of Americans but there is little chance of that. Westerners typically have used the "fastest gun" approach in allocating their water supplies. Because of this characteristic, it has been rather easy for the opponents of coal slurries, in particular, for the railroads, to stir the emotional tide against slurries. This is especially so in the Northern Great Plains Region where the annual rainfall is limited to 10 to 12 inches and, unfortunately for slurry proponents, where three of the largest proposed pipelines originate [2;9].

Coal slurries do require massive amounts of water and a general consensus is that about one ton of water, 265 gallons,

is required to move each ton of coal in a 50 percent slurry. A pipeline of ETSI's size is reputed to need at least 15,000 acre feet per year in moving 25 million tons of coal [69:5-26]. While surface water is generally either committed or will be committed as the population of the West doubles over the next 20 years, there are according to the OTA study "sufficient unused quantities of suitable water (which) are physically present, although not necessarily legally available, for the operation of several slurry pipelines from western coal producing areas." [67:5-26] In this region, it has been estimated that an average of 3.8 million acre feet of unallocated Wyoming surface water is allowed to flow out of the state and eventually into the Gulf of Mexico annually [2:9]. Just the unappropriated shares of the Tongue, Power, North Platte, and Cheyenne Rivers, some 265,000 annual acre-feet, would be significantly more than enough to feed all of the slurry projects originating in the State of Wyoming [96:91]. In addition to these resources, the Bureau of Reclamation claims that more than 3 million acre feet of the Oahe reservoir could be used for coal development purposes [2:9].

Even if surface water were totally committed, tremendous groundwater resources such as the 188,000 square mile Madison aquifer, are known to exist in the Great Plains and Rocky Mountain States. Unfortunately, hydrology, like medicine, is not near as refined as one might think and therefore, despite a mass of available data, there is an inadequate data base from which to draw long-range conclusions regarding groundwater's potential in supporting long range ventures. Some scientists claim that

the effect of a 15,000 acre-foot drawdown in Wyoming may have an adverse effect at some point in Montana or South Dakota, but other hydrologists claim that such advertisements are only scare tactics [69:27].

Controversy, such as that illustrated above, has tended to obscure the real issue of water availability. Using the Madison Aquifer as an example, its recharge rate has been stated publically to be 8,000 acre-feet per year by Dr. Perry Rand of the South Dakota School of Mines, 150,000 acre-feet per year by Hugh H. Hudson of the U. S. Geological Survey, and some unknown quantity by the Wyoming State Engineer [97:7; 98:45; 99:6]. With such variant scientific opinions, it is no wonder that both sides of the coal slurry water issue claim to be right. The OTA found that the Rand Study based its rate on an unrealistic assumption that no leakage occurs between upper level aquifers, such as the Minnelusa Formation, and lower aquifers, such as the Madison, and therefore it is likely to be erroneous. At the same time, the OTA stated while there were some drawbacks in the Geological Survey's model of the Madison, it generally was "the best picture of what was occurring. . . . " [66:19/20]

Since neither the availability of surface water nor ground water appears to be questioned, can the slurries really face a water crisis? According to Senator Floyd Haskell (Colo.), the answer is yes. While water is readily available for all the methods of energy development now under consideration in the Western States and while the coal slurry pipeline appears to be the least water intensive process under consideration, "The problem is that water is shipped to another area and not

returned." [100:31] The water problem in effect is not one of nonavailability but actually one of economics in which the Western States are being asked to give up a valued resource without remuneration.

ETSI and Northwest Pipelines have both studied the economic realities of water availability and found that their slurries can still be operated successfully even under the rigors of western laws. ETSI studied the cost of transporting water from Lake Oahe to its Gillette, WY, coal fields and estimated it would cost about $1000 per acre-foot or about 60¢ per ton of water. Its total transportation costs from Wyoming to the Mid-South area would then range to $10 per ton over the life of its thirty-year contract and hence would constitute somewhat less than a 6 percent increase over the Madison Aquifer base price. ETSI cites that municipalities along the route of its aqueduct from Oahe to Gillette could "piggy back" their water supplies on top of those for the industrial project to the benefit of both [2:9].

Northwest Pipeline studied the recycling of water as a means to reduce its water needs. Its method simply called for two parallel pipelines to be buried in the same ditch. The second pipeline would return 60 percent of the systems water while increasing the overall transportation cost by 38 percent. Some other methodologies have been studied, including the use of other liquid mediums such as methanol, but it has been found that the amount of water required to produce methanol far exceeds that needed for the slurry operations [101:539].

Although the physical supplies of water are known to exist, and the economics of slurry transport can withstand the purchase or transport costs associated with medium-distance acquisition, water permits can still be difficult to obtain because of interstate compacts, the appropriation rights doctrine, restrictive state statues, and federal ownership.

Interstate compacts are agreements between states which share common water sources which allocate the amount of water that each may take from the source without prior agreement among all of the compacts' participants. Compacts exist for virtually every river flowing through the seventeen western states but are most widely known in the Rocky Mountain and Great Plains States [96:87].

The appropriations rights doctrine is based on a "first come, first served" philosophy. Anyone or any company may file for specific rights to any reasonable amount of water from any resource and if its right is granted, the claimant is granted title to that amount of water after all others with prior granted rights have been satisfied. The holder of a relatively recent right may find it difficult to appropriate any water during times of scarcity [66:18].

Restrictive state laws abound in the West and they must be dealt with prior to any large scale investment activity [102:97]. For instance, Colorado has a statue which prohibits the exportation of water [102;99]. Wyoming requires special permission for use of water in coal transportation [101:539], and Montana has made it illegal to use any of its water in a slurry pipeline [101:540].

Federal ownership represents a sizable voice in the eleven Rocky Mountain and Pacific Coast States. The Interior Department (DOI), through its agencies, manages large expanses of the West and much of its mineral and water development. Over 48 percent of all the western land is controlled by DOI. One DOI agency, the Bureau of Land Management, administers over 358 million acres of the western Federal land alone. Table III shows the percentage of Federally-owned lands by state in the affected region. In addition to its sizable holdings, the DOI controls vast quantities of water held beneath its lands as well as the resources held in 174 irrigation projects built at a cost of $8 billion under the Reclamation Act of 1902 [104:149]. Use of these waters requires the issuance of Federal permits, which in turn requires compliance with the Environmental Protection Act, the Clean Water Act, the Occupational Safety and Health Act, just to name a few acts. The Black Mesa line uses DOI water from an Indian reservation administered by the Bureau of Land Management and has provided a valuable service to the Geological Survey by running an extensive groundwater monitoring program since 1971 [105:94].

Despite the considerable discussion generated over water availability for coal slurries, it generally has been unfounded and fraught with emotion. Slurry advocates have made good headway in the water area and presently the following observations can be made:

1. The State Engineer of Utah has granted a water permit for the Alton Pipeline [9:10].

2. The Wyoming legislature has approved ETSI's use of water for its pipeline [72:33].

3. The San Marco pipeline has a tentative April water court date which it believes will give it water rights by the Summer of 1979 [12].

4. Although the Wytex has not yet secured water, it might easily follow any of the routes described as available to ETSI during the discussion of this chapter since its intent is to originate in the same locale.

5. The Gulf-Interstate Northwest line is inactive and presently requires no resources. The Florida line has not yet announced its route. The Cadiz is not operational. The Black Mesa has current resources in use.

TABLE III

PERCENTAGES OF FEDERALLY-OWNED LAND
[103:20]

Arizona	42.8%
California	45.2%
Colorado	36.1%
Idaho	63.7%
Montana	29.7%
Nevada	86.6%
New Mexico	33.6%
Oregon	52.6%
Utah	66.1%
Washington	29.5%
Wyoming	47.8%

V. THE CASE FOR COAL SLURRY PIPELINES

The return to coal, whether it be for political expedience or pure greed, has introduced a significant number of new problems for the American public. One of the most overlooked problems is how best to transport the commodity. Americans are spoiled, even callous in their regard for transportation subsystems. After all, when you have built manned vehicles that have landed on the moon and unmanned ones that have looked closely at the majority of this solar system, a great many people begin not to be surprised when a new technology arises. Hence, when hugh liquidified natural gas (LNG) tankers, such as Leo (936 feet, 95,000 tons) were developed, the public did not bat an eye [106:9]. However, as LNG tankers began to arrive at Point Cove, Maryland, note was hastily made of the potential hazard that existed [107:6]. In fact, an anti-LNG movement quickly mounted and the search for a west coast port has been the subject of intense opposition because of the perceived threat imposed by LNG. While the California Public Utility Commission (PUC) approved a siting at Cojo Bay, near Point Conception, in August of 1978, opposition has been stiff to the project. Over two years of study will be required prior to Federal approval of that site and during that time opponents hope to eliminate the siting without having to resort to court action [108:12].

The situation for coal transport is quite similar to that for LNG. First, coal like LNG is required in tremendous quantities. The quantities defy human perception. Even when measured

in train loads rather than tons, 1.2 billion tons equate to 120,000 train loads of coat when you assume train lengths to be 100 cars. The Federal Energy Administration (FEA) states that 60 percent of 1985 traffic will be from the western coal fields, therefore, 72,000 of these train loads will be coming from the Rocky Mountain/Northern Great Plains region, a region called by many the Western coal axis. It has been previously noted that the EPRI had studied rail capacity in that area and found it to be lacking at the present time. A new study, as yet unpublished, will shortly confirm that issue. Therefore, the railroad must build, in an area where costs will be more expensive because of the terrain, to improve their capacity. In addition, because of the tremendous increase in traffic from 13,500 units in 1976 [109:113] to 72,000 in 1985, maintenance requirements will be staggering.

Although a number of studies, mostly government prepared or sponsored, indicate that the railroads can handle increased traffic, a number of private studies have indicated that this is not so. Where many government studies, including the one performed by the prestigious OTA, have given railroads the economic edge over slurries, it has been in those cases where trackage requirements were pre-existent. In any scenario where construction is required, pipelines enjoy a significant advantage over railroads. A concern to some is the effect of railroad construction on the taxpayer, in that many of the railroads have or intend to apply for funding under the 4R Act to build new trackage.

The environmental and social impacts created by rail expansion are being challenged presently. Detractors of coal movement by rail point to the 550 percent increase in traffic with alarm. Rural and urban life will be effected. Derailments, already occurring at a rate of 20,000 per year, will increase. Grade crossing fatalities, fires, cost dust scattering, and noise levels will unquestionably grow [110:3].

Railroads, when placed in this perspective, begin to lose their allure. Unfortunately, they must be used and they must be expanded despite the consequences. Even if all of the actively proposed western slurries (ETSI, Wytex, San Marco, Alton) were built and placed in operation prior to 1985, their combined movements would only account for 73.6 million tons annually, while overall production in the West would increase by 505 million tons. Obviously, the railroads will still need to increase their capacity nearly five-fold [109:112]. Fortunately, one railroad, the Denver and Rio Grande Western (D&RGW), has realized that the existing transportation system cannot perform the job that will be required and, therefore, has joined with the Southern Pacific in pioneering slurry transport. Its line, the San Marco, has been designed to fully incorporate and coordinate the use of its rail lines to complement the new slurry [110:2]. Aggressive thinking such as that exhibited by the D&RGW is required if the country is to win its fight to move Western coal.

VI. THE CASE AGAINST COAL SLURRY PIPELINES

Although a number of arguments have been raised in opposition to coal slurry pipelines, most of them have proven to be indefensible. One argument though has proven to be quite viable and has a substantial body of support. That opposition view is voiced by a constituency which sees the revitalization and rehabilitation of the national rail system as a vital national goal. To understand their sentiment requires a basic knowledge regarding the decline of the American railroad.

The twentieth century has been unkind to the railroads. A series of events beginning with the rail collapse and subsequent nationalization of the system in 1918 began the industry's problems. The Great Depression compounded its woes [111:65-75]. Massive post-World War II commitments of public funds to aid other transport modes had a substantially adverse impact on the system [112:9].

The decade of the sixties was extremely exasperating. Railroad after railroad failed financially in the Eastern districts. The industry which had once produced an attractive return for shareholders lost its prestige. Even the rail companies themselves began to look for non-railroad ventures in which to invest their revenues. Those carriers which completed such transitions now often find that their non-rail earnings often must carry the rail portion of their financial statements [112:7].

Following the collapse of the Penn Central, America's largest railroad, and eight other lines in the Northeast, unprecedented

legislation was introduced to try and resolve the problems of the eastern railroads. A 1973 attempt, the Regional Rail Reorganization Act (3R), created the Consolidated Railroad Corp. (ConRail) in an attempt to salvage the remnants of the collapsed Northeast section. Unfortunately, the experiment has been costly and it continues to grow more so every year [111:74].

Further failures occurred through the mid-1970's and subsequent legislation, the Railroad Revitalization and Regulatory Reform Act (4R), enacted in 1976, created a loan fund of $1.6 billion to provide for revitalization and rehabilitation of the sagging industry. As previously stated the resolution of the rail problem was deemed as vital to the national interests [112:31].

Despite the best intentions of Congress, the plummet has continued. On April 12, 1978, the AAR announced that the industry-wide operating income for 1977 was at its lowest since the Great Depression [113:1]. When figures for the first half of 1978 were released on October 11, 1978, operating incomes had continued their decline. An industry-wide operating deficit of $71.4 million was registered. Only the coal roads reported profits, but even their figures were depressed from the 1977 levels of the earlier report [114:1].

With the financial health of America's railroads in such a deplorable condition, a small impact could have severe repercussions. In 1976, coal, the number one commodity carried by railroads, represented the following to the railroads:

1. 29% of tonnage originated - 407.5 million tons

2. 19.9% of carloadings - 4.7 million

3. 19.5% of total ton miles - 146.6 billion

4. 14% of gross freight revenues - $2.4 billion [115:A].

Obviously, coal traffic and revenues are not distributed evenly throughout the industry, but coal is the one commodity which accounts for the financial health of nine of the ten strongest railroads [112:18; 115:A]. Without coal revenues, a collapse of the entire system could probably occur. AAR presidnet William Dempsey told the National Association of Regulatory Utility Commissioners in November of 1977 that:

> Coal slurry pipelines need not be financially successful to damage the railroads. Damage . . . will result from (their) mere existence. . . because no construction will begin until such a (long term) contract, used as a financing vehicle, is in hand. . . . [41:17].

In that same speech, he emphasized that the slurries would "skim the cream" from the most lucrative routes. In his 1978 statement before the Senate Subcommittee on Public Lands and Resources on S.707 (The Coal Pipeline Act of 1978), he indicated that such a drain would hurt Midwestern railroads attempting a recovery under the 4R Act. He said, "Any reduction in revenue could represent a threat to the financial health of any particular railroad." His sentiment has been confirmed by the Congress' own OTA study [41:17].

Whether coal pipelines are to be constructed or not will depend in part on how persuasively the arguments can be made to supporters of America's railroads. A strong group of Congressmen sitting on the Transportation Subcommittee of the House Commerce

Committee effectively defeated coal slurry legislation in 1978. Until the slurry proponents can demonstrate that their operations will not harm railroads, they may find the long and arduous fight to overcome the railroad obstacle may never end.

VII. SUMMARY AND CONCLUSIONS

A. GENERAL

It is quite evident that no confluent opinion exists regarding the viability of slurry pipelines in the United States. While a growing body of literature points to the socio-economic considerations inherent in coal slurry pipeline transit as an obvious advantage over rail transport, it appears that much of the data is a subsequent rehashing of the basic research done by a small corps of pioneers in the field. Although slurry technology is unquestionably sound, its detractors have attempted to discredit its apparent advantages and exploit its congenital weaknesses.

The modern coal slurry's oldest and most vehement foe is the railroad industry, a decaying but somewhat permanent institution that sees the slurry as a competitor rather than as an opportunity for expansion. With undue diligence a number of railroad companies have undertaken a systematic pattern of diversifying into non-railroad industries. Some, such as the Illinois Central, now IC Industries, and the Burlington Northern, now Burlington Northern, Inc., have moved into a number of ventures not only atypical of railroading, but also atypical of transportation; while other, such as the Southern Pacific and the Santa Fe, have diversified within the transportation spectrum. The Southern Pacific Transportation Co. fully developed the Black Mesa line as an extension of its obligations to the shipping

public, and Rio Grande Industries is presently prepared to do the same in constructing the San Marco Pipeline. Obviously, an economic alliance between the slurry and railroad industries might prove to be synergetic.

Coal slurry pipelines can provide an invaluable service to the shipping public. Indeed, the re-emergence of this dormant technology after nearly seventy years was hastened by the public's economic needs. Rapidly rising rail rates were arrested and subsequently decreased in direct response to the construction of the Cadiz pipeline. In addition the competitive forces of the pipeline hastened the development of the unit train concept, now the mainstay of coal transport.

Despite the slurry's potential for good, a paradox exists. It could have an adverse effect on a number of railroads. Some would argue that the entire rail rate structure would be dashed if slurries were built, thus causing massive rate increases across the board in all commodity groupings, and ultimately casting a negative effect upon the entire citizenry of the United States. Although the possibility exists that some railroads would fail as a result of competition, fear should not be used as the guiding factor in the marketplace. Because proper economic theory suggests that the issue of which transportation system survives in cases of severe competition is normally determined by which of the systems provides price and service superiority, some "constructive" destruction should be allowed to occur whenever a new industry such as coal pipelines come into being in direct competition with an existent institution such as the rail industry.

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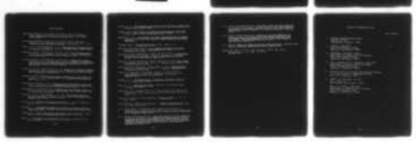

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B. SPECIFIC CONCLUSIONS

1. The Coal Issue

As coal fortunes go, so do the needs for its transportation. A number of collateral factors; namely, energy legislation, environmental quality standards, strip mining regulation, development of other on-going energy options, etc., all will have a direct effect on coal consumption in the foreseeable future. With coal presently enjoying a renascence, slurry proponents are in an excellent position to exploit the present transportation system's apparent inability to satisfy a number of large consumers' demands for economic pricing. If the fortunes of coal do not wane before the slurry advocates can solve their right-of-way problems, then the viability of a coal pipeline industry is ensured.

2. Eminent Domain Issue

While a grant of federal eminent domain cannot be predicted, it appears that the rudimentary procedures for acquiring rights-of-way along most of the lines presently proposed have been overcome at either the state levels or in the courts. Aggressive lobbying for and against slurries will be continued in both the U. S. House of Representatives and the legislatures of both Kansas and Nebraska until either statues are enacted or coal is again relegated to obscurity.

3. Environmental Issues

None of the environmental questions associated with the construction of coal pipelines have merit. In fact, the

pipeline option appears to be more sound from an environmental and aesthetic standpoint than the railroads. Even a comparison of the social impacts created by the construction and operations of either rail or slurry modes would tend to favor the use of the slurry option.

4. <u>Water Issue</u>

The water issue is a facade. Water exists in sufficient quantity to transport all of the coal presently proposed to be transported by slurry. In fact, the real issue does not appear to be related to quantity, rather it is one of penuriousness on the part of Westerners. They do not like the idea of "exporting" water without getting something in return. Money has solved this problem for other industries and it will probably solve it for the coal pipelines.

5. <u>Rail-Slurry Competition Issue</u>

Unless the regulatory framework of the Interstate Commerce Act is altered to either give the coal pipelines common carrier status or to allow the railroads to enter into long-term contracts (it cannot as a common carrier), true competition, in the direct sense, will not exist between coal pipelines and the railroads. An indirect form of competition would exist because the two systems would vie for the transportation dollars of the same customers. The railroads have in the past been able to tie their customers to "economic" contracts by requiring them to purchase and maintain private fleets of coal cars. If this practice is formalized, a direct form of price competition will ensue. If it is disallowed, the competition will be at two different planes, spot charters vs. long-term contract.

6. The Economics Issue

While pipelines promise economies not possible to railroads, it is unclear whether or not such savings can be delivered. A number of studies have indicated that in some cases railroads can be more economical than slurries, however, the data presented in most of these studies acknowledge the sources of their data as being either the prejudiced industries or other studies which employed prejudicial material. An honest evaluation cannot be made as to the economic vulnerability of the railroads or the economic potentiality of the pipelines; however, the proliferation of slurries will be assured if a measure of economic success is accorded to them during actual operations. While their throughput capabilities and hence their economic capacities have been constrained to 38-inch or less diameter pipe produced in the U.S., the Japanese have recently begun to roll seamless 56-inch pipe [116] which could double slurry capacity and provide such an economic advantage that the railroads would be forced to withdraw from the coal distribution game on a large scale.

7. The Transportation Capacity or Needs Issue

Slurries are needed. Despite assurances from the AAR, the Government, and some pro-railroad interests, doubt remains as to the ability of the railroads to fully cope with the tremendous increases of coal. Numerical analysis dictates caution be applied in accepting the railroads claim that no capacity problem exists. While rail equipment and financing appear secure, facilities and maintenance appear to be the weaklinks in expanding rail capacity. These constraints will require significant amounts of time, a commodity which is always scarce, to correct.

VIII. RECOMMENDATIONS

This study has been constrained by parameters beyond the author's control. Despite a thorough research of vast quantities of data, no first hand information was available in compiling this study. Unfortunately, much of the literature surrounding the issues of the coal pipeline controversy is biased. Because of the size and the affluence of the corporations and political entities involved, both pro and con, an air of creditability embodies the reports prepared either directly by them or for them. However, close examination shows much of the literature to be erroneous, fallacious, arbitrary, and callous. The records of the hearings before Congress regarding eminent domain reveal misrepresentation after misrepresentation of the facts. The OTA study which was to be the ultimate answer for a number of the controversial issues has proven nothing.

This thesis, although fastidiously prepared, cannot emphatically answer any of the controversial questions either. It is not known how much water is in the Madison or how the price of Texas legnite will ultimately affect the price of water in South Dakota. While this thesis has met its objectives of examining, analyzing, and commenting upon the issues, the author's ability to draw rational conclusions concerning the issues is unquestionably tainted by the literature used in the research of this paper. Therefore, it is recommended that further basic research be undertaken to determine conclusively if the data quoted in this study is valid and whether the conclusions drawn in this thesis are correct.

APPENDIX A

The following states have constitutional provisions for eminent domain [26:538]:

STATE	CONSTITUTIONAL ARTICLE
Arkansas	1, 23
Colorado	2, 14, 15
Kansas	12, 4
Montana	3, 14
Nebraska	1, 21
Oklahoma	2, 23, 24
Texas	1, 17

LIST OF REFERENCES

1. Marienthal, George, "Energy: DOD's Lifeline for National Security," Commander's Digest, v. 20, p. 3, Dec. 29, 1977.

2. Wasp, E. J. and McCamish, H.M., A Perspective on Coal Slurry Pipelines for the Next Decade, speech presented at the American Petroleum Institute's 1978 Pipeline Conference, Houston, TX, April 17-18, 1978.

3. Colorado School of Mines Foundation, Inc., The Transportation of Solids in Steel Pipelines, Golden, CO, 1963.

4. Felton, J.R., "The Utilization of the Freight Car Fleet," Land Economics, pp. 267-273, August 1971.

5. Thompson, T.L. and Wasp, E.J., "Liquid Coal: Vital to U.S. Energy," Pipeline Industry, v. 41(3), pp. 42-45, Sept 1974.

6. Southern Pacific Transportation Co., Inc., This is Southern Pacific.

7. "How the Coal Slurry in Arizona is Working," Environmental Science and Technology, v. 10, p. 1086, Nov 1976.

8. "Longest Slurry Pipeline Passes Tests," Electrical World, pp. 44-47, Feb 15, 1971.

9. Arlidge, J.W., "Energy for the Southwest and the Allen-Warner Valley Energy System," Proc. of the Second International Tech. Conf. on Slurry Transportation, pp. 3-10, Mar 2-4, 1977.

10. Hayes, Ed, Northwest Pipeline Corp., Telephone Interview, Dec. 16, 1978.

11. Houston Natural Gas Corp. and Rio Grande Industries, Inc., Proposal for a Coal Slurry Transportation System.

12. Arnold, Tom, Rio Grande Industries, Inc., Telephone Interview, Nov. 17, 1978.

13. Brown and Root, Inc., Coal Slurry Pipeline: A Transport System from Wyoming to Texas, (Preliminary Study).

14. "ETSI Connects on Pipeline Route," Coal Week, v. 3, no. 33, p. 2, April 25, 1977.

15. New York Times, "ETSI Announces Extension," Sec. IV, p. 7, col 2, April 19, 1978.

16. "Slurries Advance on Court Victory," Coal Week, v. 3, no. 33, p. 1, Aug. 22, 1977.

17. "Coal Slurry Pipeline Measure Defeated by Lop-sided 246-161 Vote in the House," Traffic World, p. 7, July 24, 1978.

18. Wasp, E. J., Thompson, T.L., and Snoek, P. E., "The Era of Slurry Pipelines," Chem Tech, pp. 552-562, Sept. 1971.

19. Rieber, M. et al, Comparative Coal Transportation Costs: An Economic and Engineering Analysis of Truck, Rail, Barge, and Coal Slurry and Pneumatic Pipelines, Prepared for the Department of the Interior, Aug. 1977.

20. Kaufman, J., Florida Gas, Telephone Interview, Dec. 8, 1978.

21. New York Times, "Florida Gas Discussing Coal Slurry Pipeline," p. 6, Feb. 8, 1978.

22. Campbell, T.C., "Eminent Domain: Its Origin, Meaning, and Relevance to Coal Slurry Pipelines," Transportation Journal, v. 17, no. 1, pp. 5-15, Fall, 1977.

23. Locklin, D.P., Economics of Transportation, 7th ed., R. D. Irwin, Inc., Homewood, IL, 1972.

24. Association of American Railroads, Coal and the Railroads-1978.

25. Slurry Transport Association, Annual Report, 1978.

26. Reed, N.T., "An Analysis of Technical and Legal Issues Raised by the Development of Coal Slurry Pipelines," Houston Law Review, v. 13, no. 3, pp. 528-550, March 1976.

27. Lowenfeld, A. F., (ed), Expropriation in the Americas, Columbia University Inter-American Law Center, Dunellen, NY, pp. 241-316, 1971.

28. "Business Briefs," Business Week, p. 36, March 24, 1972.

29. "Railroads Give Coal a Big Break," Business Week, p. 34, Mar. 9, 1963.

30. "Railroads See Threat to Their Future in Coal Slurry Legislation," Traffic World, p. 35, Oct. 13, 1975.

31. Williams, F., The Coal Slurry: a Modern Political Issue, Term Paper. Naval Postgraduate School, Fall, 1978.

32. "From Carter, A Coal Slurry Plan," Railway Age, p. 14, Feb. 27, 1978.

33. "PW Group Ends Hearings on Slurry Bills," Traffic World, p. 31, Apr. 17, 1978.

34. "O'Neal Asks ICC Certificate Control Over Proposed Coal Slurry Pipelines," Traffic World, p. 31, May 2, 1978.

35. "Energy Bill: The End of an Edyssey," Congressional Quarterly, v. XXXVI, pp. 3039-3042, Oct. 21, 1978.

36. Monterey Peninsula Herald, "Saudia Arabia to Hold Down OPEC Price Raise," Dec. 12, 1978.

37. Monterey Peninsula Herald, "Iranian Oil Strike," Jan.28, 1978.

38. Jennings, W., Opening Remarks, Proc. of the 3rd International Tech. Conf. on Slurry Transportation, p. v.

39. "West Virginia Gives Coal Pipeline Builders Clearance for Acquiring Right-of-Way," Business Week, p. 124, Feb.17,1962.

40. Bower, J.L. and Christenson, C.J., Public Management, R. D. Irwin, Inc., Homewood, IL, 1978.

41. Office of Technology Assessment, A Technology Assessment of Coal Slurry Pipelines, Washington, D.C., GPO, March 1978.

42. Wall Street Journal, "Montana Power Plan for Coal-Fired Units is Rejected by EPA," p. 32, Jun. 14, 1978.

43. Frankfurter, F., The Commerce Clause, Quadrangle Paperbacks, Chicago, IL, 1964.

44. Montana Energy Advisory Council, Coal Development Information Packet, Helena, Montana, Dec. 1974.

45. "The Meaning of the 1977 Clean Water Act," EPA Journal, p. 2, July 1978.

46. "The New Clean Air Act," EPA Journal, p. 2, Sept. 1977.

47. "The Coal Bin is Running Short," Business Week, p. 19, Jul. 5, 1969.

48. "The Big Coal Crisis Burns Itself Out," Business Week, p. 72, Dec. 5, 1970.

49. Federal Power Commission, The 1970 National Power Survey, Washington, D.C., GPO, Dec. 1971.

50. "Rival Fuels Find Themselves in the Middle of Air Pollution War on Two Fronts," Business Week, p. 22, Dec. 25, 1965.

51. Wall Street Journal, "EPA to Propose Softening some Pollution Rules," p. 2, Aug 9, 1978.

52. ABC World News Tonight, Special, Foreign Policy or Foreign Failure, Frank Reynolds reporting, April 16, 1978.

53. Executive Office of the President, The National Energy Plan, Washington, D.C., GPO, 1978.

54. National Petroleum Council, U.S. Energy Outlook: Coal Availability, USA, 1973.

55. Workshop on Alternate Energy Strategies, Energy Supply to the Year 2000, The MIT Press, Cambridge, MASS, 1977.

56. Congressional Research Service, Project Independence: U.S. and World Energy Outlook through 1990, Washington, D.C., GPO, 1977.

57. Executive Office of the President, The National Energy Plan: A Summary of Public Participation, Washington, DC, GPO, 1978.

58. Energy Research and Development Administration, A National Energy Plan for Energy Research, Development, and Demonstration: Creating Energy Choices for the Future, Washington, DC, GPO, 1976.

59. "Carter Pledges Strong Backing for Environment," EPA Journal, p. 2, Jun. 1977.

60. Monterey Peninsula Herald, "EPA Proposes $10 Billion Clean-Up Plan for Utilities," p. 12, Sept. 11, 1978.

61. Wall Street Journal, "EPA Initially to Propose Tough Standards on Sulphur from New Coal-Fired Plants," p. 6, Aug. 24,1978.

62. "Scrubbing Coal Fumes," EPA Journal, p. 8, June 1977.

63. "Sulphur-Pollutant Testing," Command Magazine, v. 1, No. 6, p. 8, Dec. 1978.

64. Godfrey, R.L., Moving Western Coal: Problems and Opportunities, Speech presented at the Conference of Professional Lease Managers, Feb. 26-28, 1975.

65. Banks, A.J. and Leemans, R.B., Energy Transportation, Paper Presented at the American Power Conference, Chicago,IL, April 20-22, 1976.

66. Rogozen, M.B. and Lawrence, W.M., "Environmental Impacts of Coal Slurry Pipelines and Unit Trains, Proc. of the 3rd International Tech. Conf. on Slurry Transportation, pp. 16-31, 1978.

67. Pipeline of the Black Mesa (film), Black Mesa Pipeline Co., Inc., Flagstaff, AZ.

68. Wasp, E. J. and Montfort, J. G., Coal Transportation Economics, Transcript of speech available through Energy Transportation Systems, Inc.

69. General Accounting Office, U. S. Coal Development: Promises, Uncertainties, Washington, DC, GPO, 1977.

70. Slurry Transport Assn., How Coal Slurry Pipelines Protect the Environment and Community Life.

71. Wasp, E. J., Progress with Coal Slurry Pipelines, speech presented at the 1975 Mining Convention of the American Mining Congress, San Francisco, CA, Sept. 30, 1975.

72. Rocky Mountain Institute of Energy and Environment, Coal Transportation - The Wyoming Issues, Laramie, WY, Mar. 28, 1978.

73. Moving Coal to Market, Coal Age, p. 241, Nov. 1951.

74. Clancey, J. T., et al, Transportation of Coal by Pipeline, U. S. Patent 2,791,471, May 7, 1957.

75. "Coal Hits a New Vein," Business Week, p. 90, Feb. 1, 1964.

76. Stover, J. F., The Life and Decline of the American Railroad, Oxford University Press, 1970.

77. Slurry Transport Assn., How Coal Slurry Pipelines Save Consumers Dollars.

78. Williams, F., The New Boys on the Block, Term Paper, Naval Postgraduate School, Summer, 1978.

79. "Authorities on Coal Supply, Haulage Enlighten Enrollees at A. U. Seminar," Traffic World, p. 38, Jun. 6, 1977.

80. "Utility-owned Rail Cars: A Boom that Rebuts the Skeptics," Railway Age, p. 29, Sept. 26, 1978.

81. Advertisement of Berwick Forge and Fabricating Co., Railway Age, p. 30, Jul. 30, 1978.

82. Bureau of Mines, Long Distance Coal Transport: Unit Trains or Slurry Pipelines, IC8690, Washington, DC, GPO, 1975.

83. Hudson Institute, Research Analysis of Factors Affecting Transportation of Coal by Rail and Slurry Pipeline, Croton-on-Hudson, NY, April 1976.

84. Peat, Marwick, Mitchell and Co., Railroad Freight Car Requirements for Transporting Energy 1974-1985, Prepared for the Dept. of Transportation, Nov. 1974.

85. Input-Output Computer Services, Rail Transportation Requirements for Coal Movement in 1980, Prepared for the Dept. of Transportation, April 1976.

86. Federal Railroad Administration, Parametric Analysis of Rail-line Capacity, Report DOT-FR-4-5014-2, August 1975.

87. Manalytics, Inc., Coal Transportation Capacity of the Existing Rail and Barge Network, 1985 and Beyond, Palo Alto, CA, Electric Power Research Institute, 1976.

88. U. S. Senate, Subcommittee on Public Lands and Resources, Committee on Energy and Natural Resources, Testimony of Craig L. McNeese on S.707 (Coal Pipeline Act of 1978) May 25, 1978.

89. Burlington Northern, Inc., Competition.

90. U. S. Senate, Subcommittee on Public Lands and Resources, Committee on Energy and Natural Resources, Testimony of William Dempsey on S. 707, May 25, 1978.

91. U. S. Court of Appeals (8th District), No. 76-1899, Burlington Northern and Others vs. The United States and the Interstate Commerce Commission, Court Brief Filed 29 March 1977.

92. Beaman, C. D., "Coal Slurry Pipelines; Electric Utility Considerations," Proc. of the 3rd International Tech. Conf. on Slurry Transportation, pp. 2-6, 1978.

93. "The Fight over Moving Coal by Pipeline," Business Week, p. 26, Jul. 27, 1974.

94. "A Railroader's Bad Day at Black Mesa," Business Week, p. 69, Aug. 4, 1975.

95. Washington Post, "Water is Key to Coal Pipeline Fight," p. A1, Dec. 1, 1969.

96. Hudson, H. H., "Water and Coal in the Northern Great Plains," Proc. of the 2nd International Tech. Conf. on Slurry Transportation, pp. 89-93, Mar. 2-4, 1977.

97. Rahn, P. D., Background Information Concerning the Proposed ETSI Well Field in Niobrara County, WY. Rapid City, SD, Jan. 18, 1977.

98. Hudson, H. H., "Water for Wyoming's Coal," Water Spectrum, p. 41, Summer 1975.

99. Reed, H. E., Underground Water in the Madison Limestone, Burlington Northern, Inc., Billings, Mont., April, 1975.

100. Haskell, F. K., "Pipelines: Cheapest Way to Move Coal," Colorado Business, p. 76, Jan. 1975.

101. Hyman, E. L., "For Want of Water: Rail vs. Slurry Transport of Coal in the Northern Great Plains," Transportation Research Forum, v. 19, pp. 533-542, 1978.

102. Erker, H. W., "Water Supply for a Coal Slurry Pipeline in Colorado," Proc. of the 2nd International Tech. Conf. on Slurry Transportation, pp. 97-100, Mar. 2-4, 1977.

103. Monterey Peninsula Herald, "Western States Howl as Government Grips Resources Tighter," p. 17, April 9, 1978.

104. Kirschsen, R.,"The Quiet Before the Shootout Over 'The Water Law of the West'," National Journal, pp. 149-153, Jan. 28, 1978.

105. Levings, G.W., "Progress Report on the Black Mesa, AZ., Groundwater Monitoring Program," Proc. of the 2nd International Tech. Conf. on Slurry Transportation, pp. 94-96, March 2-4, 1977.

106. Monterey Peninsula Herald, "Behemoth in Boston Harbor," p. 9, Dec. 19, 1978.

107. Wall Street Journal, "American Gas Assn. Advertisement, p. 6, April 15, 1978.

108. Wall Street Journal, "LNG Terminal Cleared for Cojo Bay, CA, by Utility Commission," p. 12, Aug. 2, 1978.

109. Federal Energy Administration, Annual Report, 1976-1977, Washington, DC, GPO, 1977.

110. Arnold, T. A., San Marco Pipeline: A Rail-Slurry Alternative, Presented at 4th Annual Conf. on Coal Production and Transportation, Houston, TX, April 12-13, 1978.

111. Williams, F., The Fight to Remain on Track, Term Paper, Naval Postgraduate School, Summer, 1978.

112. Rail Services Planning Office, Interstate Commerce Commission, Merger White Paper, Washington, DC, GPO, Apr. 15, 1977.

113. Assn. of American Railroads, "Operating Income Lowest Since 1930's," Information Letter, No. 2242, p. 1, April 12, 1978.

114. Assn. of American Railroads, "Big Deficit in Rail Income Seen in First Half of '78," Information Letter, No. 2255, p. 1, Oct. 11, 1978.

115. Assn. of American Railroads, Transportation's Place in the Energy Picture, 1977.

116. Monterey Peninsula Herald, "Pipe Patterns," p. 22, Feb. 14, 1979.

BIBLIOGRAPHY

American Enterprise Institute for Public Policy Research, Major Regulatory Initiatives During 1978, Washington, D.C., 1979.

American Enterprise Institute for Public Policy Research, Regulation and Regulatory Reform, Washington, D.C., 1979.

Bain, A. G., and Bonnington, S. T., The Hydraulic Transportation of Solids by Pipeline, Oxford, Pergamon Press, LTD, 1970.

Bureau of Mines, Information Circular 8706, Coal Transportation Practices and Equipment Requirements to 1985, Washington, D.C., GPO, 1976.

Bureau of Mines, Information Circular 8614, Comparative Transportation Costs of Supplying Low-Sulfur Fuels to Midwestern and Eastern Domestic Energy Markets, Washington, D.C., GPO, 1973.

Bureau of Mines, Report OFR-17(1)-18, Feasibility Study of Mining Alaska Coal and Transportation by Slurry to the West Coast, by D. Anderson, 5 Jan 1978.

Bureau of Mines, United States Energy through the Year 2000 (Revised), by W. G. Dupree and J. S. Corsentino, Washington, D.C., GPO, 1975.

Congressional Budget Office, Replacing Oil and Natural Gas with Coal: Prospects in the Manufacturing Industry, August 1978.

Department of Transportation, Transporting the Nation's Coal -- A Preliminary Assessment, Washington, D.C., GPO, Jan. 1978.

Ericksen, E. E., and Waverman, L., (ed), The Energy Question: An International Failure of Policy, Univ. of Toronto Press, Buffalo, NY, 1974.

Glass, G. B., Review of Wyoming Coalfields -- 1975, Laramie, WY, March 1975.

Goodrich, C., Government Promotion of American Canals and Railroads 1800-1890, Columbia University Press, New York, 1960.

Gordon, R.L., U. S. Coal and The Electric Power Industry, Johns Hopkins Press, Baltimore, MD, 1975.

Kolko, G., Railroads and Regulation 1877-1916, Princeton Univ. Press, 1965.

Kolson, H. M., The Economics and Control of Road-Rail Competition, Sidney Univ. Press, 1968.

Latham, Earl, The Politics of Railroad Coordination 1933-1936, Harvard Univ. Press, Cambridge, Mass., 1959.

Manalytics, Inc., Cost Models for Coal Transportation by Common Carrier, Palo Alto, CA, Electric Power Research Institute, June 1978.

"Moving Coal," Transportation USA, Fall, 1977, p. 2.

National Petroleum Council, U. S. Energy Outlook: An Initial Appraisal 1971-1985, Washington, D.C., 1971.

National Science Foundation, Report NSF-RA-75-037-F, Coal Transportation; Unit Trains - Slurry - Pneumatic Pipelines, by Soo, S.L., and others, June 1975.

National Science Foundation, Report NSF-RA-N-75-037E, Unit Train Transportation of Coal, by J. A. Ferguson and others, 1975.

National Water Commission, Report NWC-L-71-014, Federal-State Relations in Water Law, by F. J. Trelease, September 1971.

Office of Technology Assessment, Reports OTA-E-60-Pts1&2, Task Reports: Slurry Coal Pipelines, Washington, D.C., January 1978.

Pegrum, D. F., Transportation: (Economics and Public Policy), R. D. Irwin, Inc., 1973.

Stver, J. F., American Railroads, The Univ. of Chicago Press, Chicago, IL, 1961.

Tetratech, Inc., Report TT-A-642-77-306, Energy Fact Book-1977, prepared for Navy Energy and Natural Resources R&D Office, April 1977.

"Trying to Scuttle A Coal Pipeline," Business Week, p. 24, 15 Dec. 1975.

"Unit Trains; A Decade of Progress," Modern Transportation, 2nd ed., New York, 1974.

U. S. Department of Transportation, Report DOT-TST-76T-26, Western Coal Transportation, Unit Trains or Slurry Pipelines, By A. Sargeant, Aug. 1975.

U. S. House of Representatives, Hearings before the Sub-committee on Energy Research, Development, and Demonstration of the Committee on Science and Technology on Coal Slurry Pipeline Research and Development, 94th Congress, 2nd Session, January 29, 1976.

U. S. House of Representatives, Hearings before the Sub-Committee on Interior and Insular Affairs on H.R. 1609 (Coal Pipeline Act of 1977), 95th Congress, 1st Session, April 19, 25, 26, 1977.

U. S. House of Representatives, Report on the Sub-Committee on Transportation and Commerce on Coal Slurry Pipelines and H.R. 1609. The Coal Pipeline Act of 1978, 95th Congress, 2nd Session, June 1978.

U. S. Senate, Report on National Energy Transportation, Congressional Research Service, Publication 95-15, March 1978.

"Watch for These in 1978: Coal, Conrail, Steel, 4R, Labor," Railway Age, p. 20, Jan. 30, 1978.

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